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ATLAS

OF

SURGICAL & TOPOGRAPHICAL ANATOMY.

BY

B. J. BERAUD,

SURGEON AND PROFESSOR TO THE MATERNITY HOSPITAL OF PARIS;
VICE-PRESIDENT OF THE BIOLOGICAL SOCIETY;
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ERRATA AND DIRECTIONS FOR BINDER.

For Plate XLI, Perineal Region in the Male *read* Plate LXI, Perineal Region in the Male.

For Plate CX, *read* Plate XC, Gluteal Region.

For Plate CXI, *read* Plate XCI, Femoral Region.

PLATE I.

FIGURE I. — **Frontal Region.**

EXPLANATION.

A. Section of the scalp bounding the region.
B. Superficial facia.
C. Frontal portion of the occipito-frontalis muscle.
D. Section of the same.
E. Peripheral fibres of the orbicularis palpebrarum muscle.

1, 2. Frontal artery.
3, 4. Supra-orbital artery.

5. Frontal vein.
6. Temporal vein.

7, 8, 9. Lympathic vessels.

10, 11, 12. Branches of frontal nerve (5th pair).
13, 14. Branches of supra-orbital nerve (5th pair).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In plastic operations of the face, flaps are often taken from the frontal region. The distribution of the vessels, nerves, and muscles shows that these flaps should be cut in a direction parallel to the mesian line, in order to prevent mortification

The great size of the frontal vein explains why the ancients bled from this vein, and perhaps it is a mistake that this is not done in the present day, since its free communications with the veins both in the interior and on the exterior of the skull allow of the rapid depletion of all these vessels.

The nerves of this region are often the seat of neuralgia. They are also easily wounded by external injuries in consequence of the resistance of the osseous surface upon which they rest. The effects of these injuries frequently extend to the organs to which the fifth pair of nerves are distributed, hence blindness or disordered vision may arise, on the nature of which there is a difference of opinion in the present day.

The frontal sinuses are capable of becoming considerably enlarged when fracture of the anterior wall occurs, air may penetrate between the parts, giving rise to emphysema. which thus becomes the means of diagnosing the fracture. Their presence causes a difficulty in the application of the trephine, because the two tables are not parallel to each other. This arrangement does not, however, absolutely contra-indicate the operation. By taking certain precautions the section of the internal table may be accomplished without injuring the brain or its membranes. Infiltration of air does not always occur when they are opened, and when it does it is not of sufficient importance to prevent the surgeon from operating in urgent cases.

FIGURE 2. — **Parietal Region.**

EXPLANATION.

A. Section of the scalp bounding the region.
B. Superficial fascia.
C. Occipital portion of the occipito-frontalis muscle.
D. Aponeurosis of the occipito-frontalis muscle.
E. Epicranial aponeurosis.

1, 2. Terminal branches of the anterior and posterior temporal arteries.
3. Internal branch of the occipital artery.
4. External terminal branch of the occipital artery.

5, 6. Anterior and posterior temporal veins.
7. Mastoid vein.
8, 9. Occipital veins.
10. Lymphatic vessel in the occipital region.
11. Lympathic vessel passing to the occipital region.
12, 13. Lympathic vessels passing to the frontal region.

14, 15, 16. Terminal branches of the frontal and supra-orbital nerves.
17, 18. Terminal branches of the auriculo-temporal nerve.
19. Terminal branch of the occipitalis minor nerve of the cervical plexus.
20, 21, 22. Terminal branches of the occipitalis major nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In consequence of its projection this region is exposed to external injuries, such as contusions and wounds of various kinds. Moreover, the oblique direction in which the external violence acts upon the curved surface explains why the wounds are extensive and irregular. The prominence of the parietal eminence, already well defined in the fœtus, accounts for the contusions which we meet with in children at birth and especially for cephalæmatomas. These sanguineous tumours are situated betweeen the periosteum and the bone, because the periosteum is easily detached at the period of birth.

The practical deductions are the same as in the frontal region. The frontal vein has its representative in a large vein which is continuous with the mastoid vein, and might, in reality, be advantageously opened in cerebral congestion, and in extravasation into the cranial cavity.

The operation of trephining is easily performed in this region, because the two tables of the parietal bone are parallel. Formerly surgeons were afraid of trephining at the anterior inferior angle of the parietal for fear of wounding the middle meningeal artery. But wounding this artery is not so dangerous as was formerly supposed, and when it is wounded it is easily closed up by means of wax or a pledget of lint placed in the opening of the skull.

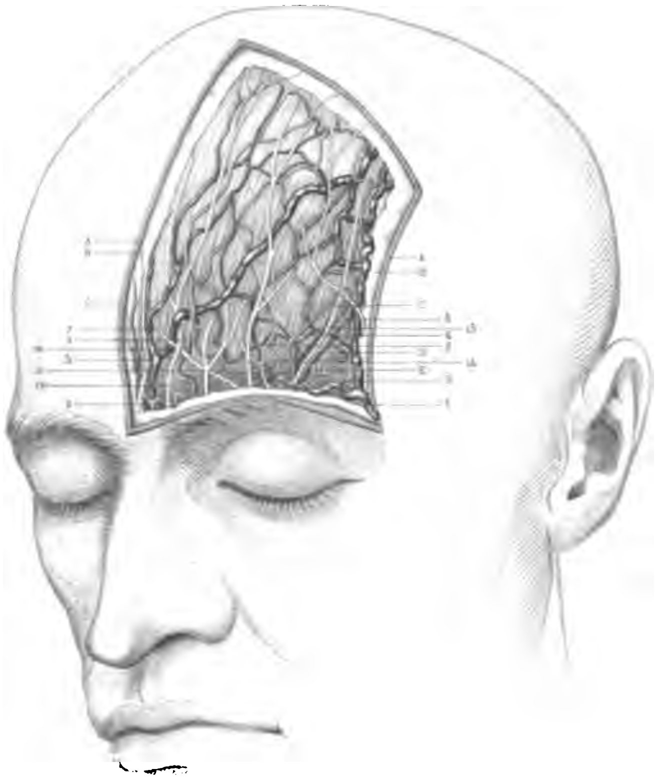

FIG 1

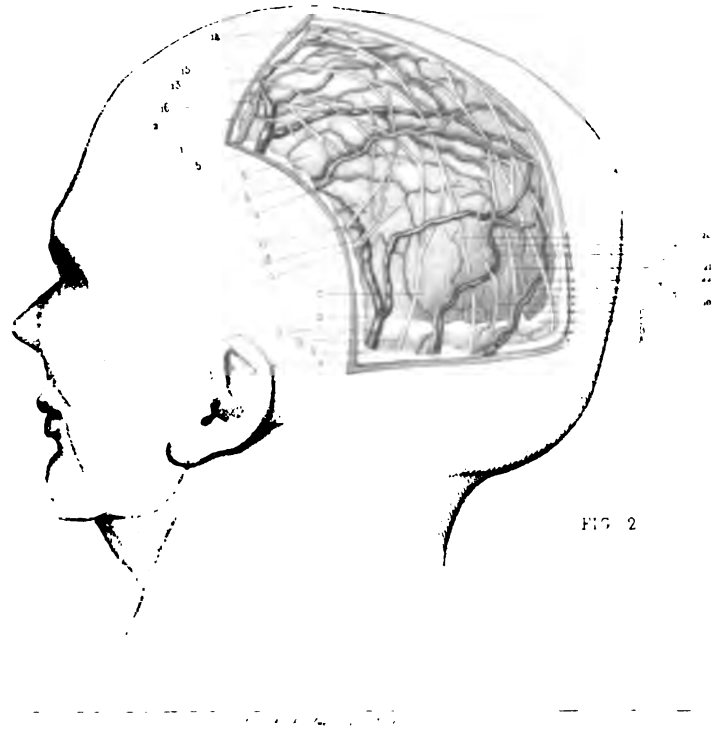

FIG 2

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PLATE II.

FIGURE 1. — **Temporal Region.**

Superficial or First Layer.

EXPLANATION.

A. Section of the scalp bounding the region.
B. Subcutaneous fascia, in which the superficial vessels and nerves ramify.
C. The attolens aurem muscle.
D. The aponeurosis of the attolens aurem; it is a continuation of the epicranial aponeurosis which divides into two layers.
E. Epicranial aponeurosis.
F. Temporal muscle.

1. Temporal artery, one of the terminal branches of the external carotid.
2. Anterior temporal artery.
3. Middle temporal artery.
4. Posterior temporal artery.

5. Superficial temporal vein.
6. Venous plexus beneath the aponeurosis anastamosing with the superficial temporal vein.

7, 8, 13. Superficial middle lympathic vessels.
9, 10, 11. Posterior superficial lympathic vessels.
12. Anterior superficial lympathic vessels.

14. Branches of the facial nerve distributed to the muscles of the frontal and supra-orbital regions.
15. Auriculo-temporal nerve (5th pair).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The superficial layer of the temporal region is formed by the same structures as the previous regions of the roof of the skull and presents similar affections.

The termination of the temporal artery furnishes anteriorly a tolerably large branch which is seen beneath the skin, and may be conveniently opened in cases of apoplexy. Notwithstanding its size this artery does not afford a large quantity of blood when it is opened, and its stream does not always flow in jets. Its position in regard to the bone renders its compression easy, and a simple bandage serves to arrest the bleeding when it has been opened.

FIGURE 2. — **Temporal Region.**

Deep, or Second Layer.

EXPLANATION.

A. Frontal bone.
B. Parietal bone.
C. Occipital bone.
D. Temporal bone.
E. Malar bone.
F. Temporal aponeurosis attached to the margin of the temporal fossa, bounding the region.
G. Section of the temporal aponeurosis.
H. The temporal muscle.
I. Section of this muscle to show the vessels and nerves which traverse its substance.
J. Tendon of the temporal muscle.

1. Posterior temporal artery (terminal branch of the external carotid).
2. Deep anterior temporal artery (branch of the internal maxillary).
3. Middle division of the deep temporal artery (a branch of the internal maxillary).
4. Posterior division of the deep temporal artery.

5. Vein going to join the superficial temporal.
6, 7, 8. Venous plexus forming a communication between the deep and superficial veins of the region.
9. Anastamosis of the superficial veins with the branches of the venous plexus.
10. Middle deep temporal vein.
11. Posterior deep temporal vein.

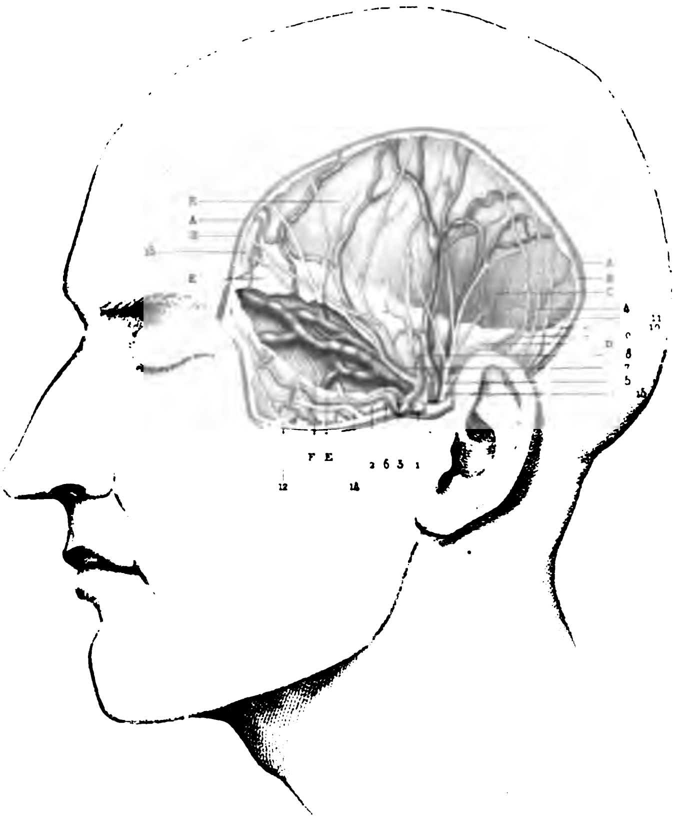
12. Anterior deep temporal nerve (5th pair).
13, 14. Middle deep temporal nerve (5th pair).
15. Posterior deep temporal nerve (5th pair).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The bones are here thin and fragile, hence the danger of wounds in this region. When a foreign body penetrates deeply into the region and reaches the bone, the numerous vessels and nerves of the part must necessarily be wounded, which thus adds to the danger of these wounds. The arrangement of the layers explains why abscesses beneath the aponeurosis open into the mouth, or on the inner surface of the ascending ramus of the lower jaw.

Trephining is seldom performed here. It was dreaded formerly, because cutting through the temporal muscle and its aponeurosis was supposed to be attended with special and serious dangers. But the division of the muscle is not dangerous, and need not deter the surgeon if the case requires trephining.

FIG 1



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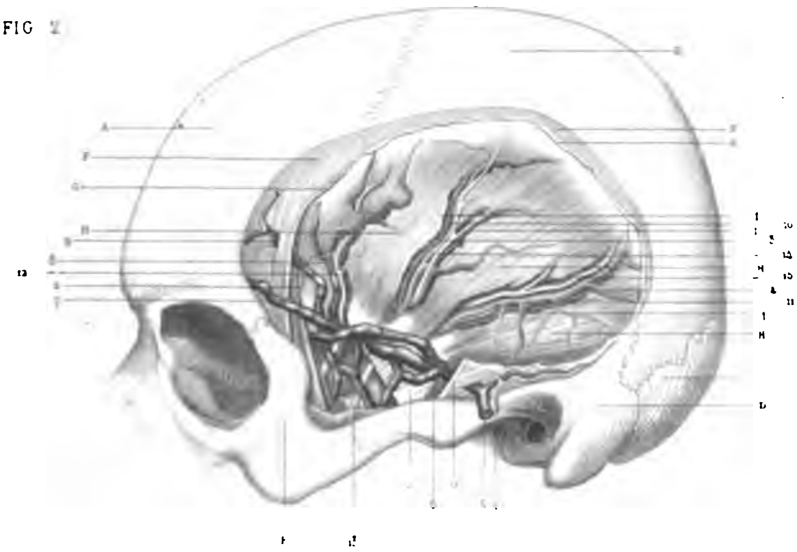

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PLATE III.

Figure 1. — **Mastoid Region.**

EXPLANATION.

A. Section of the skin forming the boundaries of region.
B. Superficial layer of the subcutaneous fascia.
C. Deep layer of the subcutaneous fascia.
D. Superior fibres of the retrahens aurem.
E. Inferior fibres of the retrahens aurem.
F. Upper portion of the sterno-cleido mastoideus muscle.
F′. Tendon of insertion of the sterno-cleido-mastoideus muscle.
G. Aponeurosis of the sterno-mastoid muscle.

1. Posterior auricular artery.
2. Artery traversing the fibres of the sterno-mastoid (a branch of the occipital).
3. Mastoid vein remarkable for its size and its isolation.
4. Posterior auricular vein.

5. Lymphatic vessels.
6. Lymphatic gland situated beneath the skin and at the apex of the mastoid process.

7. Nerve distributed to the posterior auricular and occipital muscles.
8. Posterior auricular nerve.
9. Nerve from the cervical plexus, mastoid branch.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The thinness of the skin, the quantity of cellular tissue, and the number of vessels and lymphatic glands are so many causes of the frequent and varied forms of inflammation which occur in this region. If it were not for the fear of wounding these vessels and nerves, we might, on account of its size, bleed from the mastoid vein. The vascular connexions of this region with the previous regions, as well as with the interior of the skull through the mastoid foramen, readily explain the advantages derived from local bleedings in this region in cases of inflammation either in the interior or on the exterior of the skull. The application of leeches to this part is based upon that principle.

The mastoid region is intimately connected with the organ of hearing. Thus chronic inflammation of the tympanum often becomes extended to the mastoid cells and to the osseous tissue of the process of that name, from whence arises the formation of abscesses behind the auricle of the ear, communicating with the cavity of the tympanum. We have met with several instances of this. These relations explain why trephining the mastoid cells is performed with the view of rendering the cavity of the tympanum accessible to the external air, when the Eustachian tube is obliterated. Some success has attended this operation but since the occurrence of a fatal case it has been abandoned. We think the reaction has gone too far and we hope some day to see the operation revived.

Figure 2. — **Occipital Region.**

EXPLANATION.

A. Portion of the scalp forming the boundaries of the region.
B. Subcutaneous or superficial fascia.
C. Aponeurosis of the occipital muscle.
D. Occipito-frontalis muscle.
E. The epicranial aponeurosis inserted into the superior curved line of the occipital bone.
E′. Aponeurotic expansion of the sterno-cleido-mastoideus muscle.

1. External terminal branch of the occipital artery.
2. Internal terminal branch of the occipital artery.
3, 4. Veins accompanying the occipital arteries.
5. Lymphatic glands.

6. Lymphatic vessels.

7. Sub-occipital nerve or second pair of spinal nerves.
8. Nerve from the cervical plexus, mastoid branch.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The presence of lymphatic glands in this region accounts for the inflammations so often met with here; in syphilis especially we find these glands enlarged and indurated, thus affording an important symptom for the diagnosis of a syphilitic infection. The skin of this region is very thick, it is frequently the seat of boils and carbuncles, whose importance is sometimes far more considerable here than elsewhere, in consequence of the greater thickness of the integument. The occipital region is often the seat of congenital tumours consisting of a hernial protusion of the brain, of the cerebellum, or of both at the same time covered by their membranes.

FIG. 1.

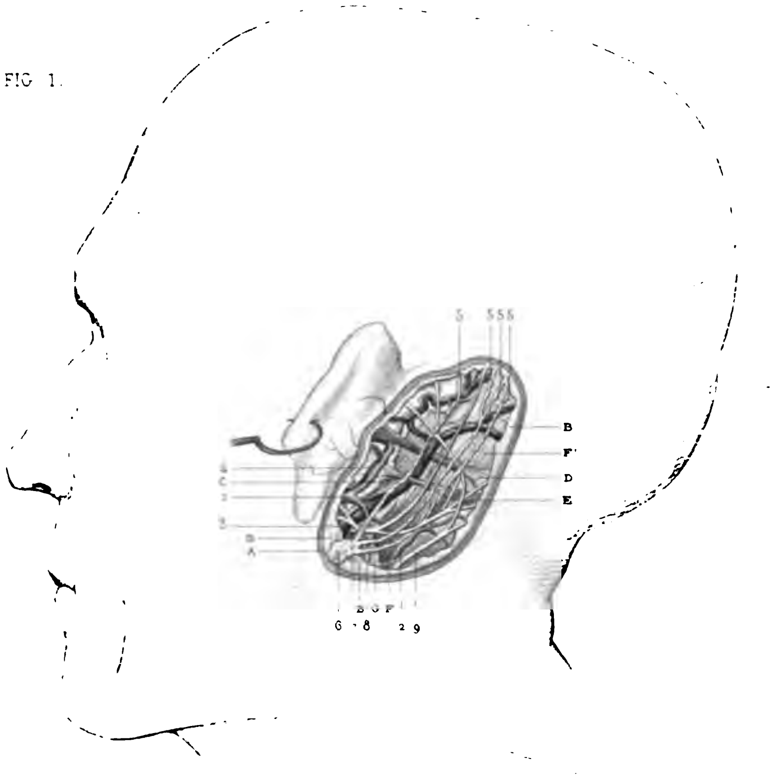

FIG. 2.

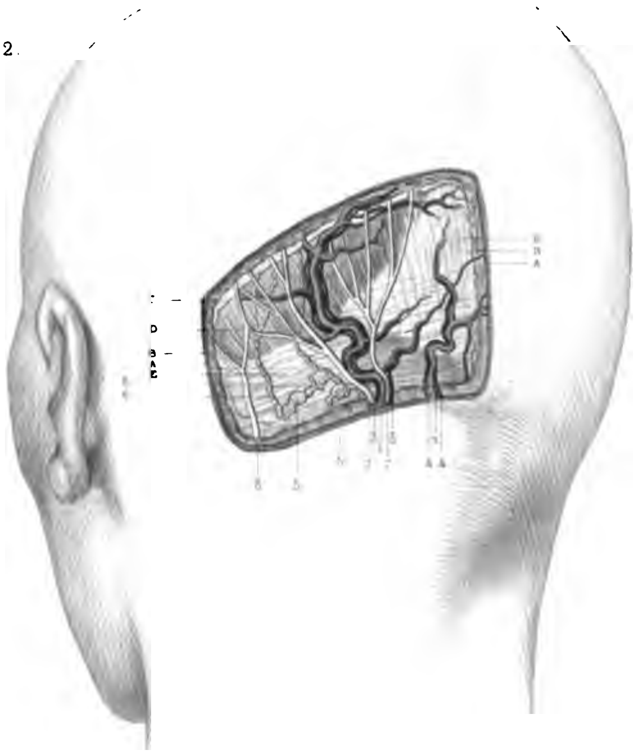

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PLATE IV.

FIGURE 1. — Region of the base of the cranium, superior surface.

EXPLANATION.

LEFT SIDE.

A. Frontal or anterior fossa.
B. Spheno-temporal or middle fossa.
C. Occipital or posterior fossa.
D. The crista Galli covered by the dura mater.
E. Section of the frontal bone.
F. Section of the sphenoid bone.
G. Section of the temporal bone.
H. Section of the occipital bone.
I. Section of the inferior and posterior angle of the parietal bone.

1. Section of the internal carotid artery.
2. Origin of the opthalmic artery.
3. Section of the trunk of the basilar artery.
4. Ramifications of the middle meningeal artery.

5. Coronary sinus.
6. Cavernous sinus.
7. Transverse sinus.
8. Superior petrosal sinus.
9. Inferior petrosal sinus.
10. Occipital sinus.
11. Lateral sinus.
12. Torcular Herophili.
13. Superior longitudinal sinus laid open.
14. The straight sinus laid open.

RIGHT SIDE.

1. Section of the medulla oblongata.
2. Section of the membranes surrounding the medulla oblongata.
3. Openings in the cribiform plate of the ethmoid giving passage to the filaments of the olfractory nerve.

4. Optic nerve.
5. The motor oculi nerve.
6. Nervus patheticus.
7. Fifth pair of nerves.
8. Nervus abducens.
9. Facial nerve.
10. Auditory nerve.
11. Glosso-pharyngeal, pneumo-gastric, and spinal nerves.
12. Hypoglossal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The depressions, irregularities, and projections presented by this region, although eminently adapted to separate and protect the various organs in the interior of the skull, at the same time expose them to contusions and concussions. Thus it is not uncommon for blows on the roof of the skull to produce severe injuries at the base of the brain, the more dangerous, because they involve the parts most essential to life.

The presence of a large number of arteries and veins on the inferior surface of the brain favours the production of extensive hæmorrhages which speedily cause death, especially when situated near the pons Varollii or the medulla oblongata. In these cases, it seems to us that death is owing both to the compression and to the concussion, and sometimes to the contusion of the brain.

FIGURE 2. — Region of the base of the cranium seen from its inferior surface.

EXPLANATION.

RIGHT SIDE.

A. Perpendicular plate of the ethmoid.
B. Occipital foramen.
C. Frontal sinus.
D. Ethmoidal cells.
E. Roof of the orbit formed by the frontal bone.
F. Middle spongy bone.
G. Suture between the sphenoid and frontal bones.
H. Groove lodging the spheno-palatine artery.
I. Sphenoidal sinus.
J. External pterygoid plate.
K. Hamular process of the internal pterygoid plate.
L. Suture between the temporal and sphenoid bones.
M. Base of the zygomatic process.
N. Foramen ovale giving passage to the 2nd division of 5th pair of nerves.
O. Anterior root of the zygomatic process.
P. Foramen spinosum giving passage to the middle meningeal artery.
Q. Posterior root of the zygomatic process.
R. Glenoid cavity.
S. Carotid foramen.
T. Fissura Glasseri.
U. External opening of the auditory canal.
V. Foramen lacerum posterius giving passage to the internal jugular vein.
X. Base of the styloid process.
Z. Mastoid process.
a. Digastric groove.
b. Mastoid foramen giving passage to the mastoid vein.
c. Foramen giving passage to a vein.
d. Condyle of the occipital bone.
e. Inferior curved line of the occipital bone.
Superior curved line of the occipital bone.

LEFT SIDE.

A. Section of the skin.
B. Inferior oblique muscle of the eye.
C. External rectus muscle of the eye.
D. Inferior rectus muscle of the eye.
E. Internal rectus muscle of the eye.
F. Tendinous inter-section of temporal muscle.
G. Section of the masseter muscle.
H. Section of the external pterygoid muscle.
I. Section of the internal pterygoid muscle.
J. Edge of the circumflexus palati muscle.
K. Section of the levator palati muscle.
L. Section of the stylo-pharyngeus muscle.
M. Section of the stylo-glossus muscle.
N. Section of the stylo-hyoideus muscle.
O. Section of the right rectus lateralis muscle.
P. Section of the sterno-cleido-mastoideus muscle.
Q. Section of the digastric muscle.
R. Section of the internal fibres of the biventer cervicis muscle.
S. Section of the external fibres of the biventer cervicis muscle.
T. Section of the splenius capitis muscle.
V. Section of the obliquus superior muscle.
X. Section of the trapezius muscle.
Z. Section of the rectus capitis posticus major muscle.
a. Section of the complexus muscle.
b. Section of the rectus capitis posticus minor muscle.
c. Section of the rectus capitis anticus major muscle.
d. Section of the rectus capitis anticus minor muscle.
e. Section of the conjunctiva.
f, i. Section of the periosteum of the orbit.
g. Section of the temporal aponeurosis.
h. Section of the periosteum of the orbit.
j. Section of the capsule of the tempero-maxillary articulation.
k. Section of the capsule of the articulation of the occipital bone with the atlas.
l. Eustachian tube.
m. Section of the fibrous tissue covering the basilar process from the occipital foramen to the external occipital protuberance.

1. Section of the internal carotid artery.
2. Section of the internal maxillary artery terminating in the spheno-palatine artery.
3. Section of the infra-orbital artery.
4. Section of the posterior palatine artery.
5. Section of the middle meningeal artery.
6. Section of the tympanic artery.

7. Sinus of the internal jugular vein.
8. Section of the internal maxillary vein.
9. Section of the middle meningeal vein.
10. Section of the mastoid vein.

11. Section of the 5th pair of nerves: in the centre of this nerve there is seen an artery and a vein.
12. Branch of the 5th pair of nerves passing to the temporal fossa.
13. Branch of the 5th pair of nerves which ramifies in the temporal muscle.
14. Superior maxillary nerve (2nd division of the 5th pair).
15. Posterior palatine nerve (branch of the spheno-palatine ganglion).
16. Nerve going to the inferior oblique muscle of the eye
17. Corda tympani nerve.
18. Pneumogastric nerve.
19. Spinal nerve.
20. Hypo-glossal nerve.
21. Facial nerve.
22. Great sympathetic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Fractures at the base of the skull almost invariably pass through one or more of the numerous orifices giving passage to the vessels and nerves; hence the possibility of compression and contusion of these vessels and nerves, and thus aneurism or paralysis may result from these fractures. The nerves most frequently affected are those which have the longest passage through the substance of the bone; the facial most frequently of any.

FIG 1.

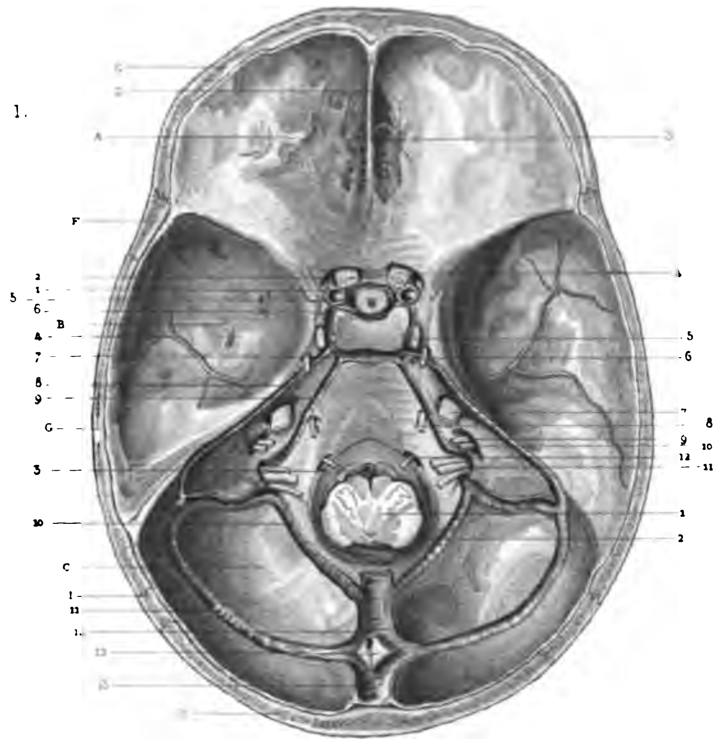

FIG 2.

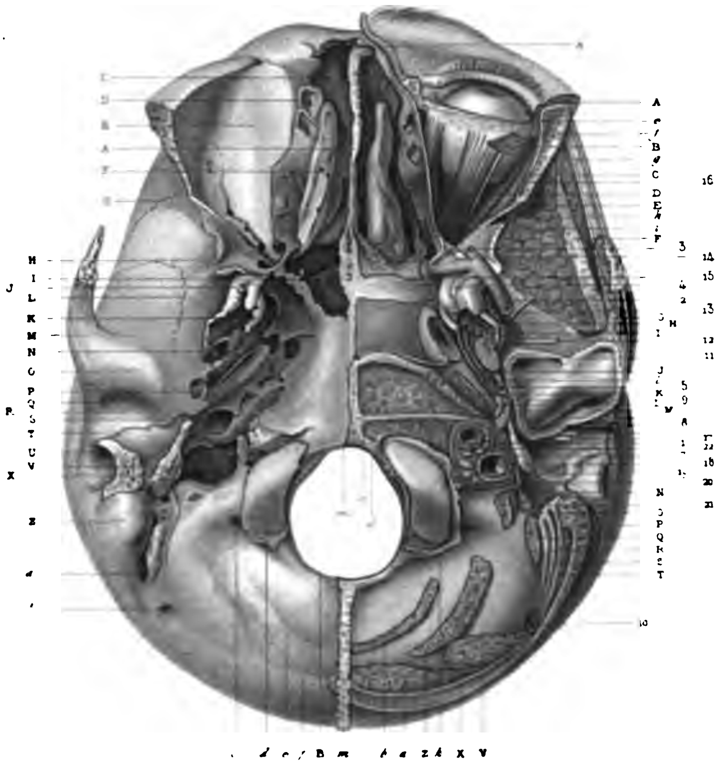

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PLATE V.

FIGURE 1. — Antero-posterior section of the roof of the skull, and of the organs contained in the skull. Arrangement of the soft parts covering the bones.

EXPLANATION.

A. Section of the skin.
B. Section of the superficial fascia.
C. Section of the epicranial aponeurosis.
D. Section of the frontal portion of the occipito-frontalis muscle.
E. Section of the occipital portion of the same.
F. Section of the frontal bone.
F′. Frontal sinus.
G. Section of the dura mater.
G′. The dura mater turned back.
H. Superior longitudinal sinus.
I. Inferior longitudinal sinus.
I′. Opening of the vena Galeni.
I″. Straight sinus.
J. The confluence of the sinuses.
J′. Lateral sinus.
K. Falx cerebri.
L. Falx cerebelli.

1 Anterior convolutions of the brain.
2. Section of the corpus callosum.
3. The knee or bend of the corpus callosum.
4. Posterior inflexion of the corpus callosum.
5. The lateral ventricle.
6, 6′, 7, 8. The fornix.
9. Anterior commissure of the brain.
10. Optic layer.
11. Annular protuberance.
12. The pineal gland.
13. Commissure of the optic nerves.
13′. Optic nerve.
14. Common motor nerve of the eye.
15. Section of the internal carotid artery.
16. Anterior cerebral artery.
17. The choroid plexus
18. Posterior cerebral artery.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This section shows the number of layers protecting the brain. Amongst them some are hard, such as the bones, which, if they protect it, at the same time they prevent a tumour or a collection of fluid from making its way externally giving rise to symptoms of compression, which can only be relieved by the removal of a portion of the bone. This constitutes the operation of trephining which was formerly much employed.

The roof of the skull is strong and resisting, and is provided with firm sutures, which in the adult prevent the exit of the parts beneath. In the fœtus and in the child at birth, the roof of the skull has portions which are not ossified, these are the fontanelles, through which the brain with its membranes sometimes form a hernia producing congenital encephalocele.

Along the mesian line of the roof of the skull is the superior longitudinal sinus. It has been recommended not to trephine at this part for fear of hœmorrhage, of phlebitis, or of the entrance of air into the sinus. These dangers are imaginary, and when necessary we may trephine in the mesian line.

FIGURE 2. — Transverse section of the roof of the skull; arrangement of the soft parts covering the bone in this region.

EXPLANATION.

A. Section of the scalp.
B. Section of the superficial fascia.
C. Section of the epicranial aponeurosis, which divides into two layers at the temporal fossa, to form a sheath for the attolens aurem.
D. Section of the aponeurosis of the temporal muscle which divides near its insertion into the zygoma forming a space containing fat.
E. Section of the temporal muscle.
F. Section of the bones of the roof of the skull.
G Section of the basilar process.
H. Section of the zygomatic process.
I. Fat contained between the two layers of the aponeurosis of the temporal muscle.
J. Section of the dura mater.
K. Section of the falx cerebri.
L. Anterior cerebral fossa.
M. Fold of the dura mater, separating the anterior and middle cerebral fossæ.
N. Middle cerebral fossa.

1. Section of the internal carotid artery.
2. Section of the opthalmic artery.

3. Section of the commissure of the optic nerves.
4. Optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This section is intended to show how the effects of blows on the roof of the skull are transmitted to its base, and explains the manner in which the petrous bone may be fractured by an indirect cause. The force of a blow is transmitted direct to the sides of the skull, and then begins to be decomposed: at the junction of the roof with the base, the curve is no longer regular and the force becomes decomposed in the following manner; one portion tends to increase the angle formed by the base with the roof, while the other portion is transmitted to the base itself. The first force sometimes produces a transverse fracture of the petrous bone, while the second passes in the direction of the axis of the petrous bone and expends itself amongst its numerous articulations, or, if it is very violent, it fractures the bone near its internal extremity.

The frequent occurrence of fracture of the petrous bone, apparently so strong, [illegible] the presence of the ear cavity in its interior, and the inclination of its axis in an oblique direction fro [illegible] nd from behind forwards. In consequence of this direction an angle is formed at this part [illegible] y the external violence and thus becomes one of the principal causes of fracture.

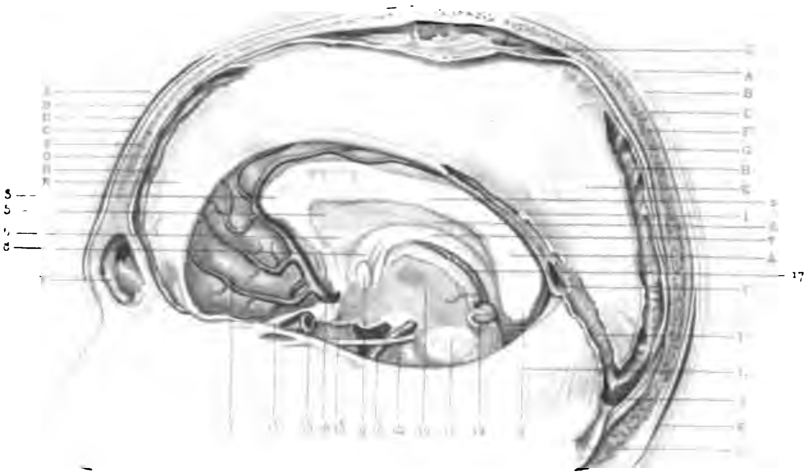

FIG. 1

FIG. 2

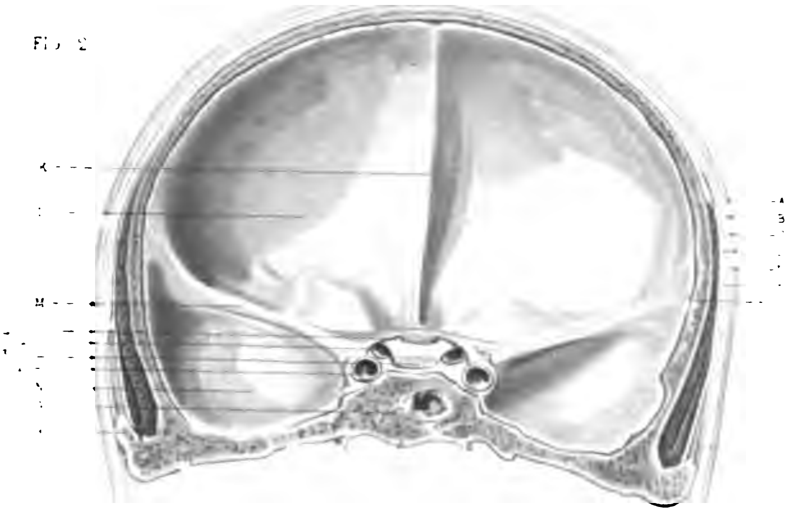

PLATE VI.

FIGURE 1. — **Superior surface of the brain, covered by its membranes.**

EXPLANATION.

A. Section of the skin.
B. Section of the occipito-frontalis muscle.
C. Section of the temporal muscle.
D. Section of the occipito-frontalis muscle.
E. Section of the frontal bone.
F. Section of the temporal bone.
G. Section of the parietal bone.
H. Section of the occipital bone,
I. External surface of the dura mater.
J. Section of the dura mater forming the wall of the superior longitudinal sinus.
K. Section of the dura mater to show the layer of the arachnoid covering the brain.
L. Superior longitudinal sinus.
M. Arachnoid membrane (cerebral layer).
O. Section of the arachnoid.

P. External surface of the pia mater.
Q. Section of the pia mater.
R. Sulci of the brain.
S, T. Convolutions of the brain.
U. Glands of Pacchioni.

1. Middle meningeal artery.
2, 3. Veins of the pia mater.
4. Section of the frontal vein.
5. Section of the deep temporal artery.
6, 7. Section of the temporal vein.
8. Occipital vein.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The superior surface of the brain is protected by several layers of various consistency, but all admirably adapted for the purpose. The bones of the roof of the skull constitute the envelope affording the strongest protection. But if these bones are fractured, there is danger of the brain being wounded by the spiculæ, and fragments of the displaced bones, which are sometimes driven into the brain by the violence of the external force. As, however, these bones are separated from the substance of the brain by membranes possessing considerable resistance, this organ is not always injured in fractures of the roof of the skull.

Various kinds of tumours are met with on the surface of the brain: the fungoid being the most frequent. The development of these tumours present three distinct stages. During the first, the tumour is in the interior of the skull and presses upon the convolutions, this period is not always indicated by disturbance of the cerebral functions, because the compression comes on slowly and gradually, so that the brain accommodates itself to it. The second period is characterised by the wearing away and thinning of the bones, this is the parietal period, parchment-like crepitation may be detected. The third or extra-cranial period is marked by the presence of a tumour of variable size, more or less reducible, and accompanied by the phenomena of paralysis and coma when either a partial or complete reduction of it is attempted.

FIGURE 2. — **The inferior surface of the brain covered by its membranes.**

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C. Section of the temporal muscle.
D. Section of the occipito-frontalis muscle.
E. Section of the frontal bone.
F. Section of the parietal bone.
G. Section of the occipital bone.

H. Section of the dura mater.
I. Section of the falx cerebri.
I′. Section of the falx cerebelli.
J. Section of the superior longitudinal sinus.
J′. Section of the occipital sinus.
K. External surface of the arachnoid.
L. The pia mater.

M. Convolutions of the brain.
N. Sulci of the brain.
O. Laminæ of the cerebellum.
P. Pons varolii.

1. Section of internal carotid artery.
2. Section of the vertebral artery.

3. Bulb of the olfactory nerve.
4. Section of the optic nerve.
5. Section of the motor nerve of the eye.
6. Section of the nervus patheticus.
7. Section of the fifth pair (small root).
8. Section of the fifth pair (large root).
9. Section of the nerve of Wrisberg.
10. Section of the nervus abducens,
11. Section of the facial nerve.
12. Section of the auditory nerve.
13. Section of the glosso-pharyngeal nerve.
14. Section of the pneumo-gastric nerve.
15. Section of the spinal nerve.
16. Section of the hypo-glossal nerve.
16′. Section of the medulla oblongata.
17. Section of the tuber cinereum.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The inferior surface of the brain includes the encephalic organs most essential to life, it is also more effectually protected than the superior surface. Nevertheless blows and fractures may produce contusions and severe injuries. Extravasation of blood, and inflammation, sometimes occur, giving rise to paralysis in the course of the nerves that are situated in the vicinity of the extravasation, or of the inflammation. We can, therefore, diagnose the seat of the extravasation from the nerve that is paralysed.

These intra-cranial extravasations may have various seats. Thus the blood may accumulate between the bone and the dura mater, as happens most frequently. It may also collect between the layers of the arachnoid membrane, in the pia matter or beneath it, in the substance of the brain, or in the ventricles. The diagnosis of the exact seat of these extravasations of blood, or of purulent matter, is not easy, and it is no doubt this difficulty which often prevents the interference of the surgeon. (See *Manuel d'Anatomie chirurgicale et topographique*, par MM. Velpeau et Béraud, Paris, 1862, p. 60. 2nd. edit).

FIG 1

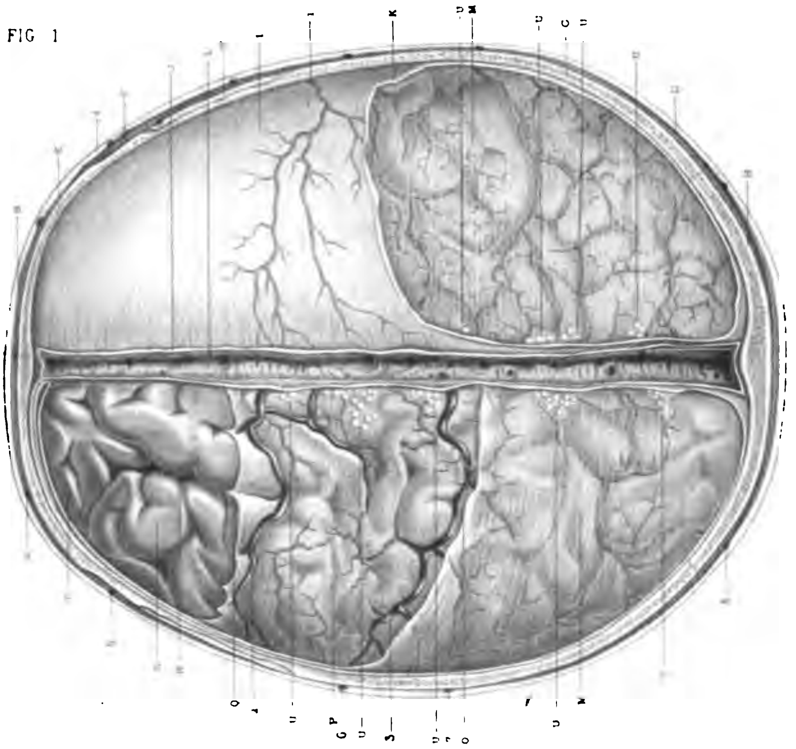
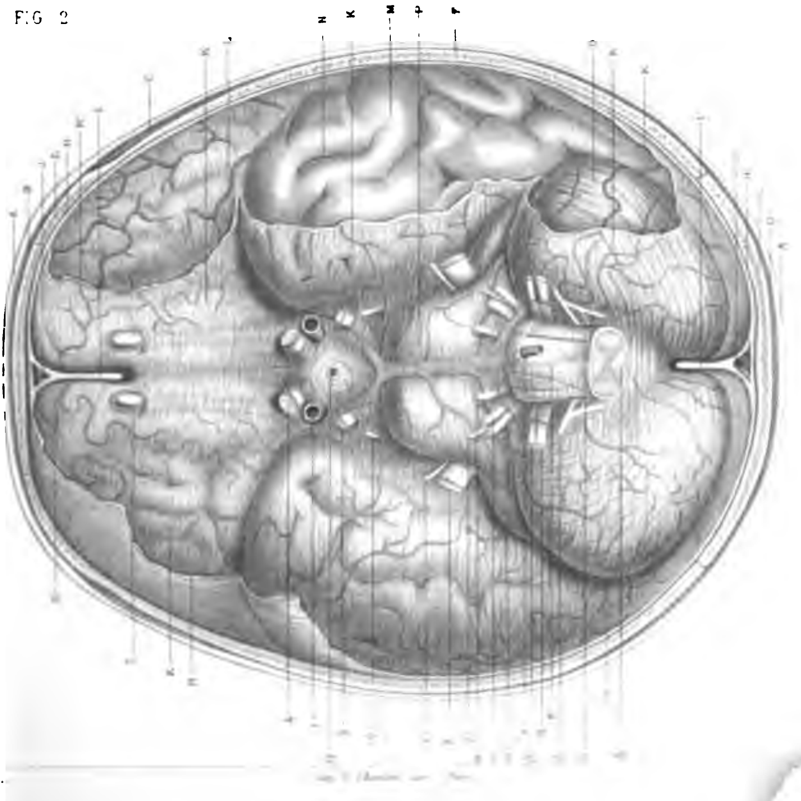


FIG 2



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LIBRAIRIE GERMER BAILLIÈRE

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FIG. 1

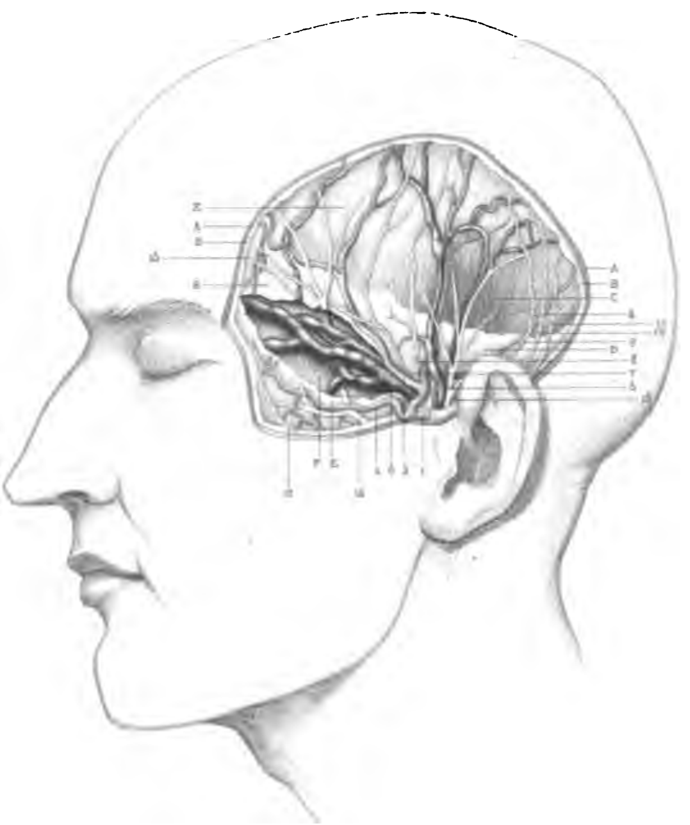
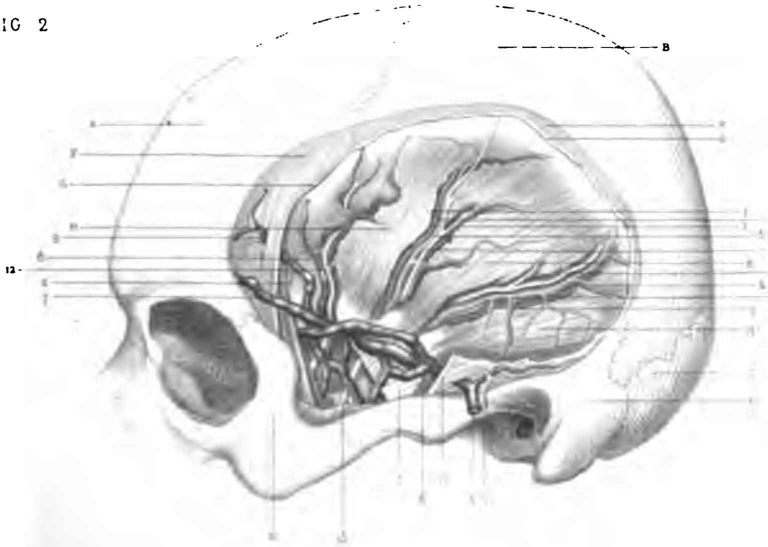


FIG. 2



LIBRAIRIE GERMER BAILLIÈRE

PLATE VI.

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F. Section of the temporal bone.
G. Section of the parietal bone.
H. Section of the occipital bone,
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J. Section of the dura mater forming the wall of the superior longitudinal sinus.
K. Section of the dura mater to show the layer of the arachnoid covering the brain.
L. Superior longitudinal sinus.
M. Arachnoid membrane (cerebral layer).
O. Section of the arachnoid.

P. External surface of the pia mater.
Q. Section of the pia mater.
R. Sulci of the brain.
S, T. Convolutions of the brain.
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F. Section of the parietal bone.
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H. Section of the dura mater.
I. Section of the falx cerebri.
I′. Section of the falx cerebelli.
J. Section of the superior longitudinal sinus.
J′. Section of the occipital sinus.
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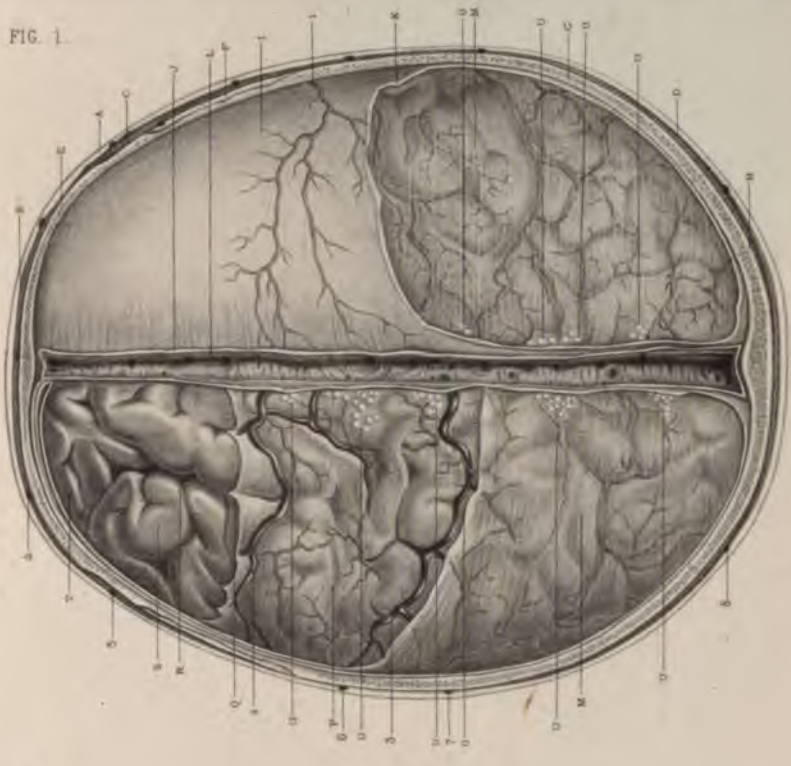
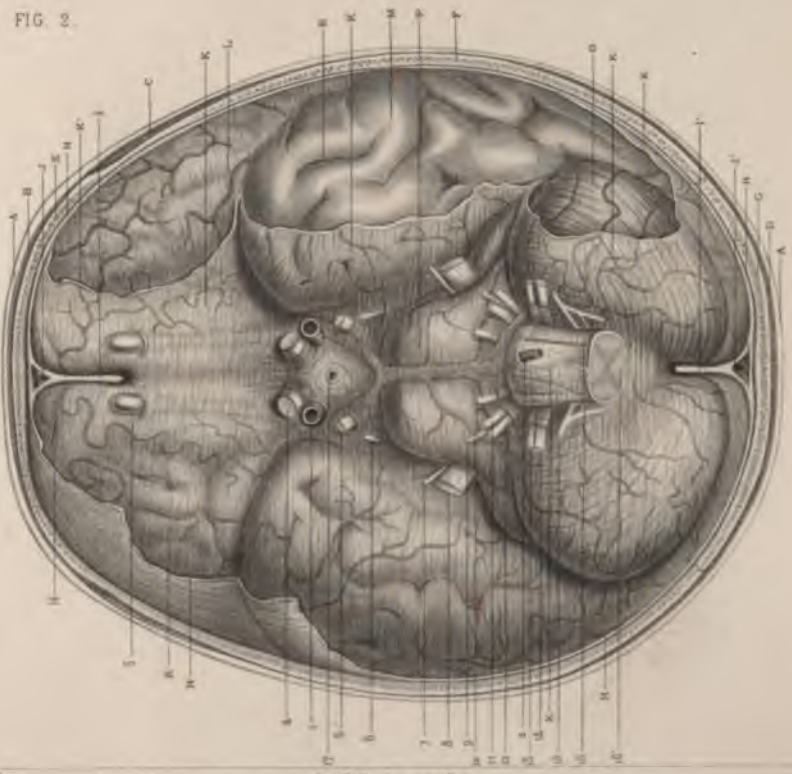


FIG. 2.



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LIBRAIRIE GERMER BAILLIÈRE.

PLATE VII.

Figure 1. — **Region of the auricle of the Ear.**

External surface.

EXPLANATION.

A. Section of the skin.
B. Cellular fatty tissue of the lobule of the ear.
C. Fibrous receptacle of the parotid gland.
D. External opening of the auditory canal.
E. The concha.
F. The tragus.
G. The anti-tragus.
H. The helix.
I. The cavity of the helix.
J. The anti-helix.
K. The two branches of the anti-helix.
L. The fossa of the anti-helix.
M. Muscle of the tragus.
N. Muscle of the anti-tragus.
O. The great muscle of the helix.
P. The small muscle of the helix.

1. Inferior auricular artery (branch of the external carotid).
2. Auricular artery coming from the inner surface of the ear.
3, 3′. Anterior auricular arteries furnished by the parotid arteries and anastomising with the superior and inferior auriculars.

4. Inferior auricular vein.
5, 5′. Inferior auricular veins.
6. Superior auricular vein.

7. Auricular nerve coming from the cervical plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The skin of the external surface of the auricle of the ear is furnished with a considerable number of small glands, whose secretions serve to lubricate the part and principally that portion of it near the external auditory canal. The presence of these glands accounts for the frequent occurrence of small tumours in this region. These small cysts sometimes become of considerable size. There is also found between the skin and the cartilage of the auricle tumours containing blood, they are so far peculiar that they are especially observed in the insane and in pugilists, they appear to be always due to repeated pressure or to a violent blow.

The tragus and anti-tragus are sometimes too near each other, and so conceal the entrance to the auditory canal and render the person hard of hearing. The treatment of this defect consists in introducing a dilator, or in excising the malformed or over-sized parts.

Figure 2. — **Region of the auricle of the Ear.**

Internal surface.

EXPLANATION.

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1. Temporal artery.
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3, 4. Posterior auricular arteries.
5. Branches of the auricular artery.

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The lobule of the ear is often pierced for the purpose of attaching ear-rings to it. The absence of vessels and nerves in the part explains the harmless nature of the operation and the little pain with which it is accompanied.

A large number of vessels are present in this region, and thus we not unfrequently meet with erectile tumours of veins and arteries, which are of consequence because they cannot be cured by tying a single vessel, but most frequently it is necessary to apply a ligature successively to the external carotid, then to the common carotid, and even to the arteria innominata.

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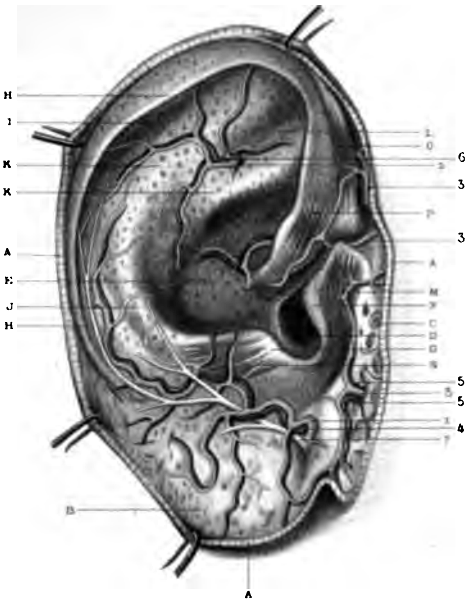

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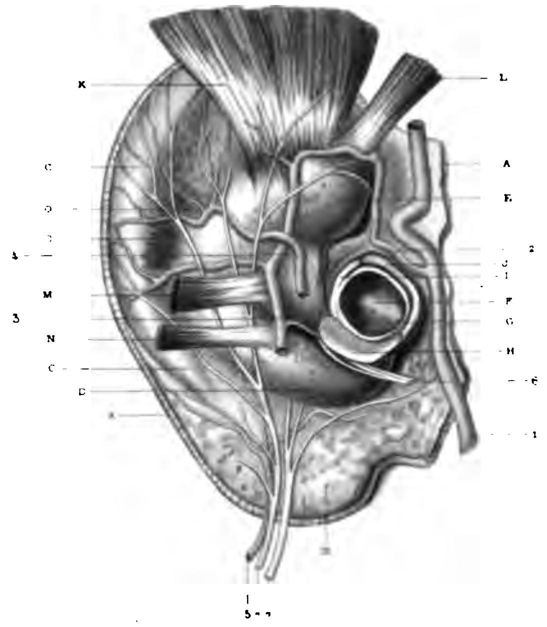

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LIBRAIRIE GERMER BAILLIERE

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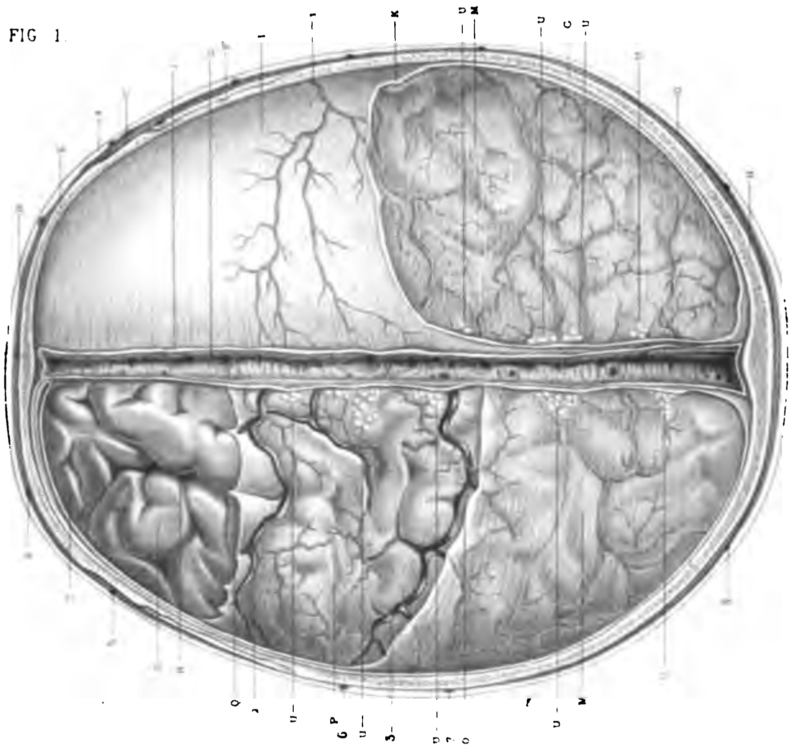
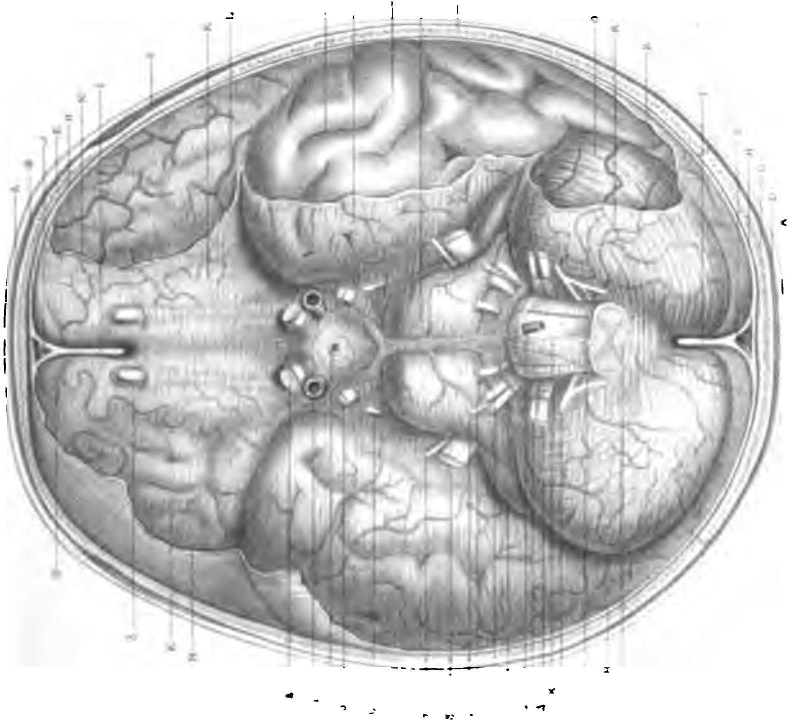


FIG. 2.



LIBRAIRIE GERMER BAILLIÈRE

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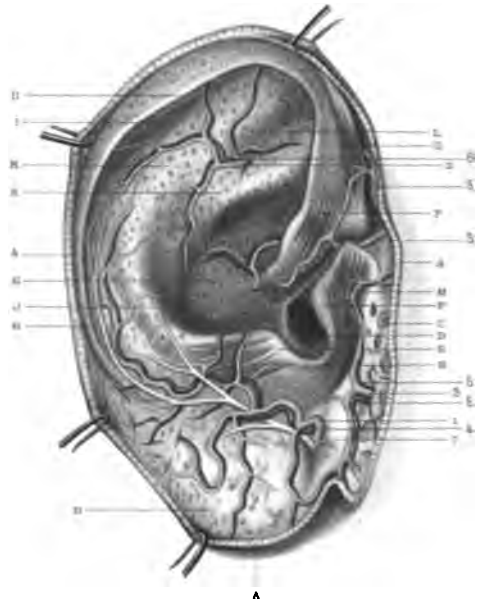
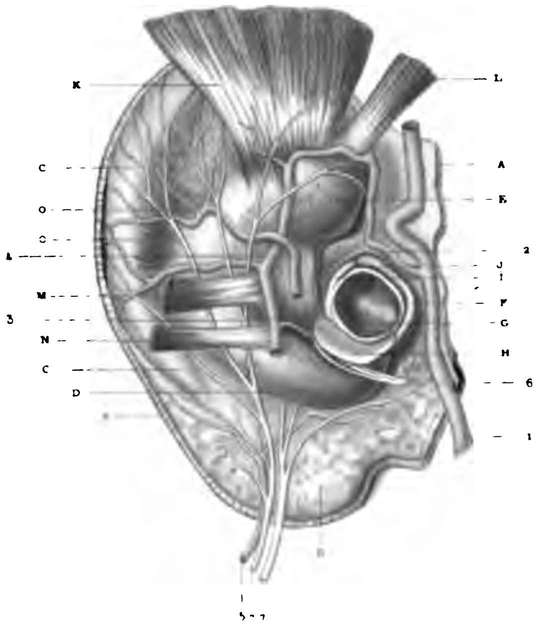


FIG. 2.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE IX.

FIGURE 1. — **Region of the entire auditory apparatus.**

EXPLANATION.

A. Lobule of the ear.
B. The tragus.
C. The helix.
D. The anti-helix.
E. Posterior branch of the anti-helix.
E′. Anterior branch of the anti-helix.
F. The concha.
G. Section of the external cartilaginous ring.
H. Section of the second cartilaginous ring.
I. Section of the first cartilaginous ring.
J. Section of the second cartilaginous ring.
K. Third cartilaginous ring of the external auditory canal.
L. Section of the cellular tissue.
M. A serous sack which facilitates the movements of the external auditory canal upon the base of the styloid process
N. The external auditory canal showing its inflexions, direction, curves, and ceruminous glands.
O. The membrana tympani its external surface and its inclination in relation to the axis of the external auditory canal.
P. Mastoid process.
Q. Styloid process.
R. Opening of the anterior jugular cell into the cavity of the tympanum.
R′. Opening of the inferior jugular cell into the cavity of the tympanum.
R″. Opening of the internal jugular cell into the cavity of the tympanum.
S. Jugular fossa.
T. Articular surface of the occipital bone.
U. Section of the pterygoid process.
V. Sphenoidal sinus.
X. The sella turcica.
Z. Superior mastoid cell.
a. The incus.
b. The malleus.
c. Opening of the Eustachian tube.
d. Superior fibres of the circumflexus palati muscle.
e. Middle fibres of the same muscle.
f. Inferior fibres of the same muscle.
g. Superior fibres of the insertion of the levator palati muscle.
h. Small fasciculus of muscular fibres passing from the Eustachian tube to the lateral walls of the pharynx.
i. Another fasciculus of muscular fibres having the same arrangement.
j. The tensor tympani muscle.
k. The laxator tympani muscle.

1. Internal carotid artery.

2. The facial nerve in the meatus auditorius internus.
3. Facial nerve in the aqueduct of Fallopius.
4. Geniculated ganglion.
5. Large petrosal nerve.
6. Small petrosal nerve.
7. Corda tympani.
8. Vidian nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The serous sack which exists at the inferior and internal extremity of the external auditory canal has not been previously described. The diseases of this bursa have to be studied, and it is probable that certain abscesses supposed to be connected with the parotid are situated here. May not the extravasations of blood met with in pugilists and in the insane be seated in this cavity?

In front of the jugular fossa are seen three openings through which the cells, we have named jugular cells, communicate with the cavity of the tympanum, a circumstance of physiological and pathological importance.

FIGURE 2. — **Region of the cavity of the tympanum, of the openings of the mastoid and jugular cells, of the Eustachian tube, and of the round and oval foramina.**

EXPLANATION.

A. Condyle of the occipital bone.
B. Sphenoidal sinus.
C. Section of the pterygoid process.
D. Transverse section of the middle portion of the mastoid process.
E. Mastoid cells.
F. Bristle showing the communication of these cells with the cavity of the tympanum.
G. Jugular fossa.
H. Jugular cells communicating with the tympanum.
I. Internal wall of the cavity of the tympanum.
J. Depression of the inferior portion of the tympanic cavity.
K. Upper portion of the petrous bone.
L. The malleus.
M. The incus.
N. Portion of the tympanic cavity traversed by the nerve of the same name.
O. Tympanic opening of the Eustachian tube.
P. Section of the cartilaginous wall of the tube.
Q. Section of the membranous wall.
R. Opening of the Eustachian tube into the pharynx.

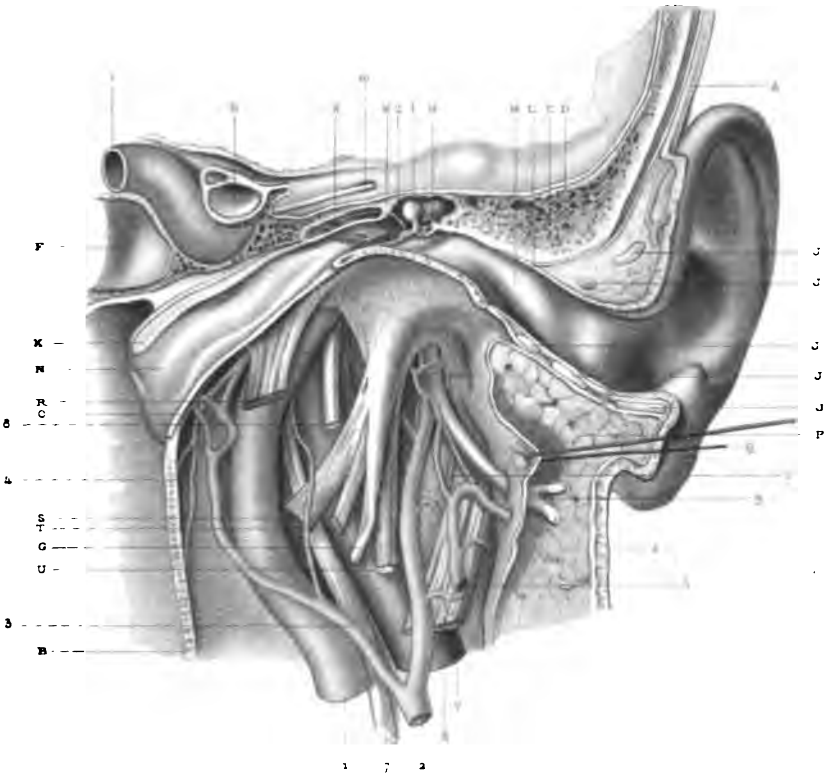
1. Internal carotid traversing the base of the skull behind the Eustachian tube.

2. Facial nerve.
3. Chorda tympani nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The fibrous, osseous, and cartilaginous structure of the Eustachian tube explains why it is always open, and that contraction or narrowing of it is very rare. Sometimes, however, it is obstructed by mucus or compressed by tumours in the vicinity, producing more or less loss of hearing. In order to remedy this condition the operation of catheterising the Eustachian tube is adopted and the operation is sometimes followed by the injection of air or of the vapour ether. The direction, form, and capacity of the Eustachian tube, and its precise relations with the ear, the al fossa and the pharynx, which are represented in several of the figures serve to guide the surgeon in the per-ance of this operation. The situation of the pharyngeal extremity of the Eustachian tube enables us to reach it from the mouth or from the nasal fossa. At first this was done from the mouth, but at present the direction of al fossa is preferred.

FIG. 1



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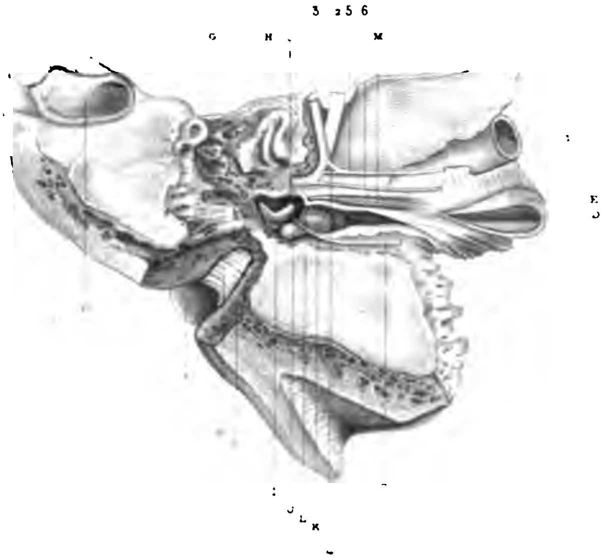

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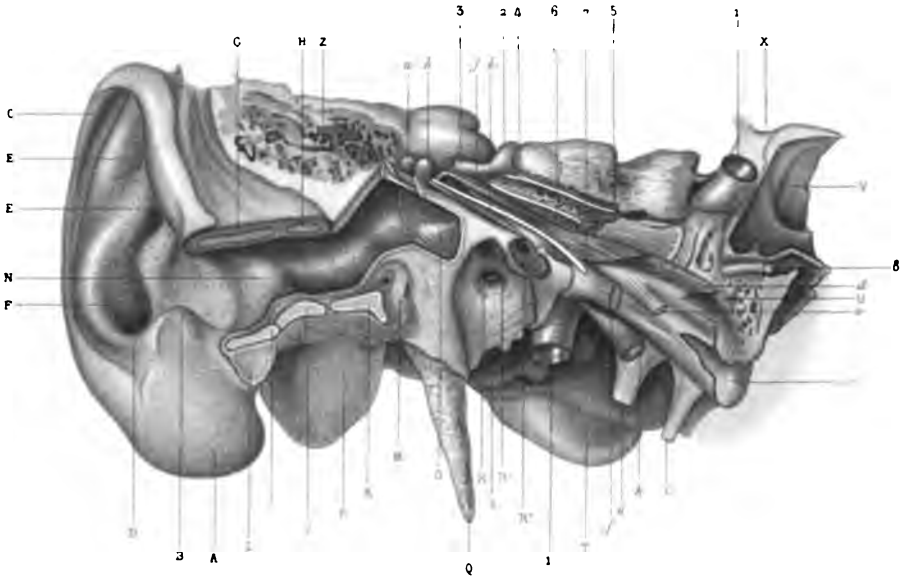

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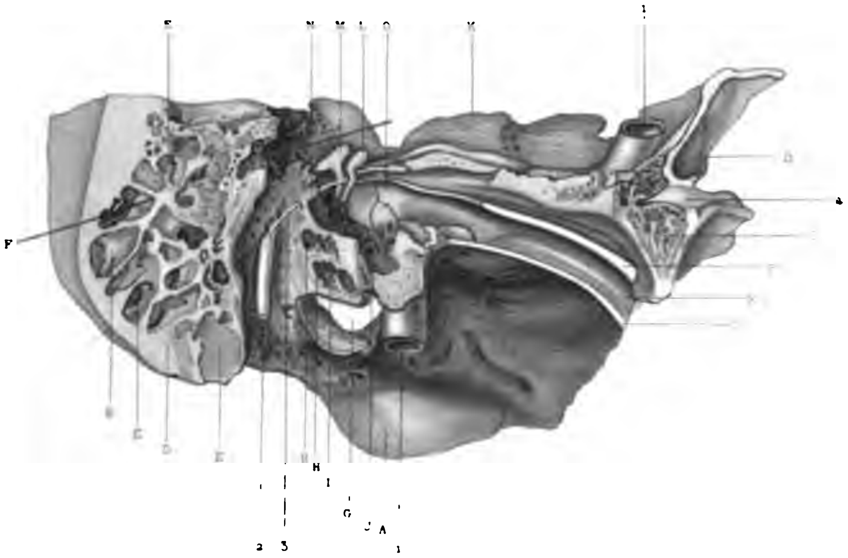


PLATE X.

FIGURE 1. — **Region of the middle Ear.**

EXPLANATION.

A. The sella turcica.
B. External wall of the sphenoidal sinus.
C. Condyle of the occipital bone.
D. Anterior condyloid foramen.
E. Section of the mastoid process at its posterior part.
F. Mastoid cells.
G. Superior semicircular canal.
H. External semicircular canal.
I. Posterior semicircular canal.
J. Foramen rotundum.
J'. Foramen ovale.
J''. The stapes.
K. The stapedius muscle.
L. Tendon of the same muscle.
M. The promontory.

1. Internal carotid accompanied by the great sympathetic nerve.
2. Facial nerve.
3. The geniculated ganglion.
4. Great petrosal nerve.
5. Small petrosal nerve.
6. Jacobson's nerve.
7. Branch of Jacobson's nerve distributed to the fenestra rotunda and to the mucous membrane of the tympanum.
8. Branch of Jacobson's nerve going to the Eustachian tube.
9. Branch of Jacobson's nerve anastomosing with the great petrosal nerve.
10. Small filament of Jacobson's nerve anastomosing with the small petrosal and furnishing in its course a small branch which is distributed to the mucous membrane in the neighbourhood of the fenestra ovalis.
11. A branch of Jacobson's nerve anastomosing with the sympathetic.
12. Great sympathetic nerve.
13. The spheno-palatine ganglion.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The cavity of the tympanum contains air which communicates with the mastoid cells, and with the pharynx by means of the Eustachian tube. If the stethoscope is applied to the base of the mastoid process, and the person is directed to close the nostril on the opposite side by means of the finger and to blow through the nostril that is open, a sound is distinctly heard indicating the entrance of air into the mastoid cells. If there is a small quantity of mucus in the Eustachian tube or in the cavity of the tympanum, a gurgling sound is heard similar to the mucous râle. By practice we may distinguish several of these sounds, and thus diagnose changes in the cavity of the tympanum, the mastoid cells or the Eustachian tube; it must, however, be admitted that the subject requires further investigation.

FIGURE 2. — **Region of the internal Ear.**

EXPLANATION.

A. The middle cerebral fossa.
B. Fossa for the cerebellum.
C. Foramen lacerum posterius.
D. Membrana tympani.
E. The malleus seen from its upper surface.
F. The incus seen from its upper surface.
G. The cochlea.
H. The lamina spiralis of the cochlea.
I. The vestibule.
J, K. Posterior semicircular canal.
L. External semicircular canal.
M. Superior semicircular canal.
N. Tendon of the tensor tympani muscle.
O. The laxator tympani muscle.

1. Internal carotid giving origin to the ophthalmic artery.
2. Internal carotid passing through the petrous bone and its relation with the cochlea.
3. Origin of the ophthalmic artery.
4. Middle meningeal artery.
5. Middle meningeal vein.
6. Optic nerve.
7. The common motor nerve of the eye (3rd. pair).
8 Nervus patheticus (4th pair).
9. The nervus abducens (6th pair).
10. Fifth pair of nerves.
11. Facial nerve.
12. Auditory nerve.
13. The chorda tympani nerve.
14. Small petrosal nerve.
15. Great petrosal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The labyrinth or internal ear is the essential part of the auditory apparatus. It may be affected by disease of the petrous bone and is exposed to congenital and other disorders. All these diseases are difficult to treat or to detect, on account of the minuteness of the organ, the depth at which it is placed, and the thickness of the structures by which it is surrounded.

In internal otitis, the inflammation which at first occupied the tympanum may easily extend to the labyrinth, and when this has occurred the auditory nerve has been found red and surrounded by pus and blood, thus explaining the temporary and sometimes permanent deafness which follows this disease.

The relations and structure of the labyrinth explain the various theories that have been offered to account for the discharge of serous fluid which accompanies fracture of the petrous bone. At different times this fluid has been said to come from a clot of blood formed in the centre of the fracture, from the lateral sinus, from the liquid of Cotunnius, and lastly from the sub-arachnoid space, and from the cavity of the arachnoid. In the present day, it is known that the cerebro-spinal fluid is most frequently the source of the discharge.

In order that this discharge may pass out of the external auditory canal the membrana tympani must be torn. The external wall of the vestibule contains the membrane of the fenestra rotunda and several other openings which form communications between all the cavities of the labyrinth with the vestibule. It follows from this that if the fenestra rotunda is open, the fluid of the labyrinth will escape into the tympanum, and will either pass through the torn or perforated membrana tympani into the external auditory canal, or through the Eustachian tube into the pharynx. This, in fact, is what happens in fractures of the petrous bone. But, that this may take place, it is necessary that the vestibule should communicate with the tympanum, either through a fissure, or through the ruptured membrane of the fenestra rotunda. Moreover, this membrane may be torn and the liquid escape without a fracture of the petrous bone. This, at least, is what is shown by some recent cases.

Fig. 1

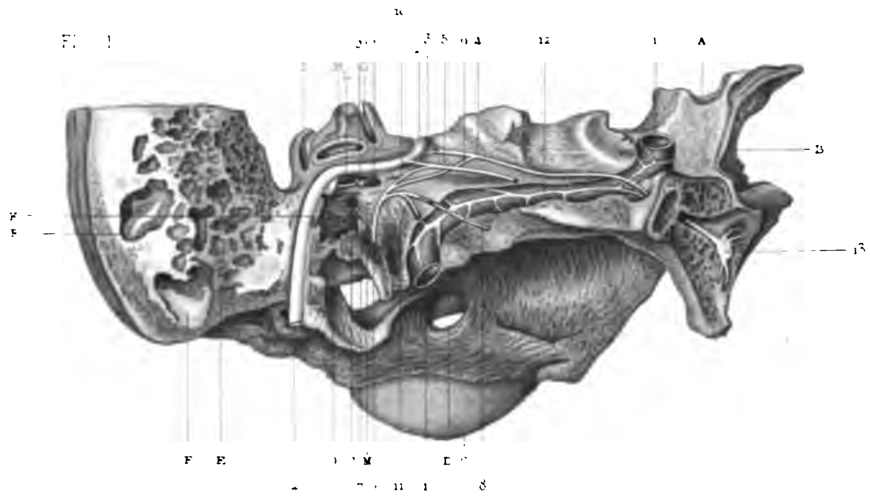
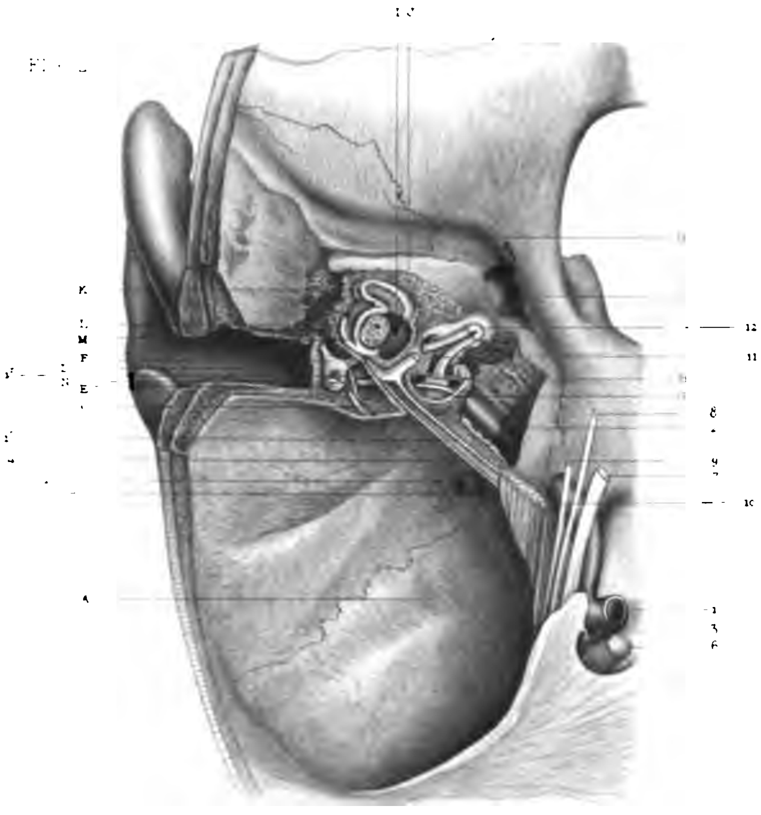


Fig. 2



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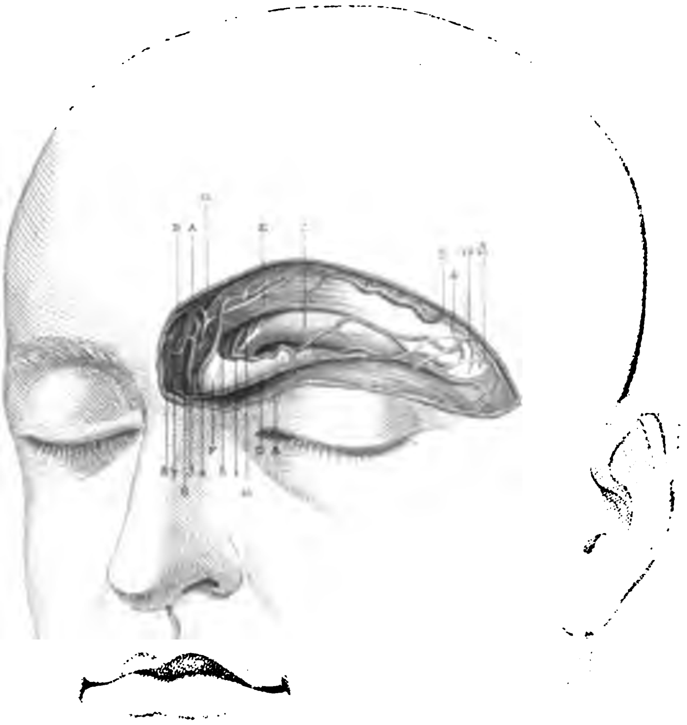
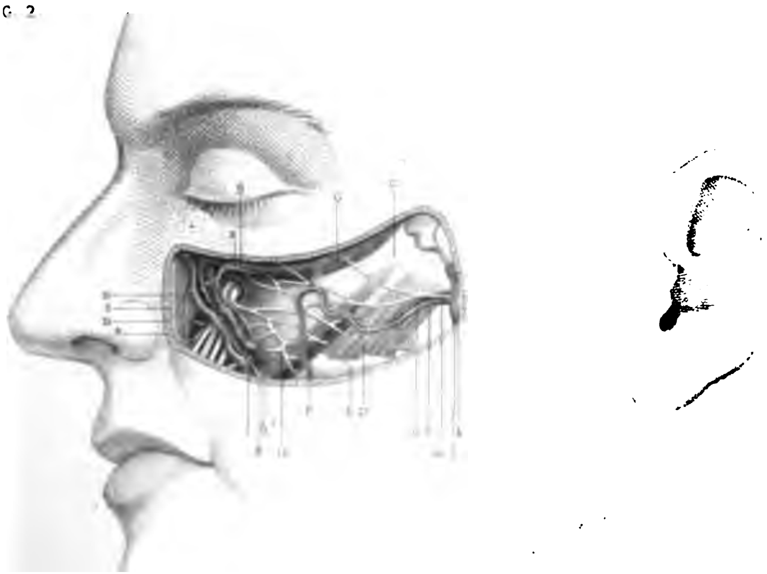


FIG 2



LIBRAIRIE GERMER BAILLIERE

PLATE XV.

Figure 1. — Region of the Orbit.

Orbital canal.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Fibres of the occipito-frontalis muscle interlacing with those of the orbicularis palpebrarum.
D. Section of the fibres of the orbicularis palpebrarum.
E. Portion of the orbicular muscle turned outwards.
E′. Temporal muscle.
F. Section of the frontal bone.
G. Section of the periosteum of the frontal bone.
H. Section of the aponeurosis of the orbit.
I. The lachrymal gland.
J. The palpebral aponeurosis forming the anterior wall of the orbital canal.
K. External orifice of the orbital canal.
L. Orifice of the canal traversing the orbicular muscle of the eyelids.
M. Filament of the lachrymal nerve passing through this canal to be distributed to the skin.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The canal which we have named the *orbital canal* is to the cavity of the orbit what the crural canal or the inguinal canal is to the cavity of the abdomen. It gives passage to vessels and nerves. It thus forms a communication between the interior of the orbit and the subcutaneous cellular tissue. If blood is extravasated into the substance of the eyelid above the palpebral aponeurosis it will make its way to the surface on this side. If an abscess forms in the orbit, the pus has a tendency to obtain an exit by this canal, and this in fact is what is seen in practice without our being able to account for it. It follows therefore that an abscess in the orbit should be opened opposite the external orifice of this canal.

Figure 2. — Region of the Orbit.

Orbito-ocular aponeurosis.

EXPLANATION.

A. Margin of the orbit.
B. Lachrymal canal.
C. Hooks stretching the ocular aponeurosis.
E. Section of the superior rectus muscle passing through the ocular aponeurosis.
F. Section of the inferior rectus muscle passing through the ocular aponeurosis.
G. Section of the internal rectus muscle passing through the ocular aponeurosis.
H. Section of the external rectus muscle passing through the ocular aponeurosis.
I. Section of the inferior oblique muscle passing through the ocular aponeurosis.
I′. The insertion of the inferior oblique muscle into the margin of the orbit.
J. The superior oblique muscle.
K. Pulley for the reflected tendon of the superior oblique muscle.
L. Tendon of the superior oblique muscle after it has passed through the ocular aponeurosis.

1. The optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This portion of the aponeurosis shows how the globe of the eye is, so to speak, separated from the orbital cavity. In extirpation of the eye, if care is taken not to injure the barrier formed by this fibrous membrane, the operation is far less dangerous than if it is perforated, because then the soft parts of the orbit become inflamed and suppurate, and may thus propagate the inflammation and suppuration to the cranial cavity. By preserving this aponeurosis, there is the further advantage of having a support upon which it is more easy to adapt an artificial eye.

To accomplish this, we must proceed in the following manner: the conjunctiva is first to be divided at its inner portion, and the internal rectus cut through; then, by means of the scissors, we successively divide the superior rectus, the external rectus, the superior oblique, the inferior rectus, and the inferior oblique muscles near to their insertions, and terminate the operation by dividing the optic nerve close to the eye.

Figure 3. — Region of the Orbit.

Insertion of the recti muscles on the globe of the eye.

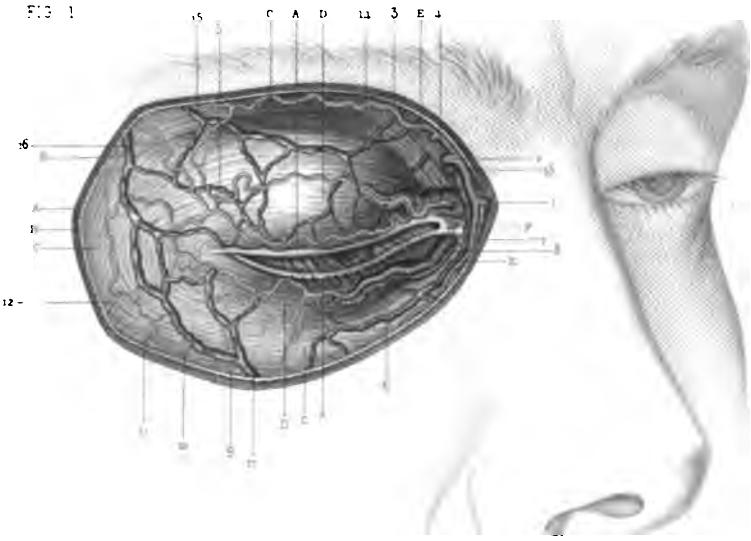
EXPLANATION.

A. Tendon of the superior rectus inserted into the sclerotic.
B. Tendon of the inferior rectus inserted into the sclerotic nearer to the cornea than the superior rectus.
C. Tendon of the internal rectus inserted into the sclerotic.
D. Tendon of the external rectus stronger than the preceding and inserted farther from the circumference of the cornea than the internal rectus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The tendon of the internal rectus muscle is the one which is inserted nearest to the circumference of the cornea, and is also the one most easily divided. The ocular portion of all the tendons of the muscles of the eye are intimately attached to the sclerotic for a certain space and are expanded over the globe of the eye, as it were over a pulley of reflexion; so that when they are divided they must be carefully raised by means of a blunt hook to avoid wounding the sclerotic or even opening the eye. Opposite each tendon, the globe of the eye presents a depression so that it has somewhat of a quadrangular form. This arrangement is especially distinct when the globe of the eye is distended by an accumulation of the vitreous humour, for instance, or from any other cause.

FIG 1



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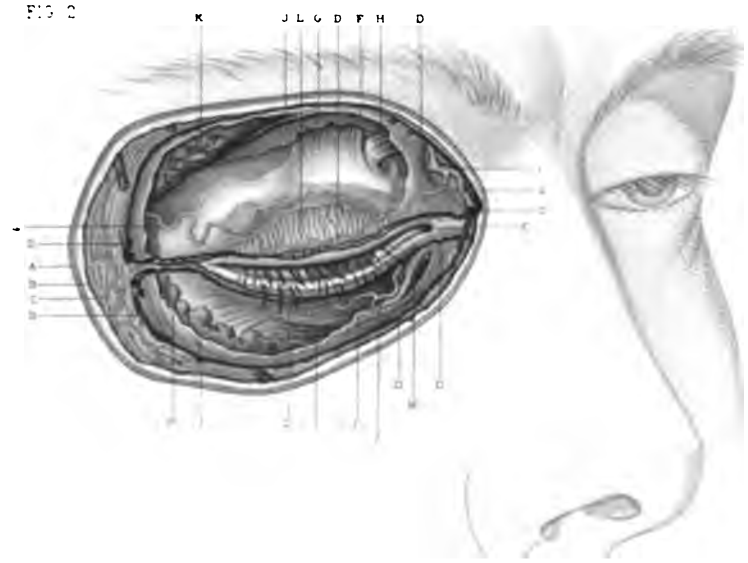


LIBRAIRIE GERMER BAILLIERE

PLATE XVI.

Figure. 1.—Region of the Orbit.

The orbito-ocular aponeurosis and the anterior orbital insertions of the muscles of the eye.

EXPLANATION.

A. Section of the frontal bone.
A′. Frontal sinus.
B. Section of the superior maxillary bone.
B′. The maxillary sinus.
C. Canal through which the infra-orbital nerve passes.
D. Section of the malar bone.
E. Elevator muscle of the upper eyelid.
E′. Aponeurotic expansion of the tendon of the elevator muscle of the lower eyelid.
F. The superior rectus muscle.
F′. Aponeurotic expansion of the tendon of the superior rectus.
F″. Aponeurotic expansion of the tendon of the superior rectus.
G. The inferior rectus muscle.
G′. Aponeurotic expansion of the tendon of the inferior rectus.
H. Section of the internal rectus muscle near its tendon.
H′. Tendon of the internal rectus.
H″. Tendinous or aponeurotic expansion, or reflected portion called also *orbital tendon* of the internal rectus passing to be inserted into the inner wall of the orbit.
I. Section of the external rectus muscle near its tendon.
I′. Tendon of the external rectus muscle.
I″. Tendinous or aponeurotic expansion, or reflected portion called also *orbital tendon* of the external rectus passing to its insertion on the external wall of the orbit.
J. Superior oblique muscle of the eye.
J′. Superior oblique muscle in its pulley of reflexion.
J″. Aponeurotic expansion of the internal rectus passing towards the elevator muscle of the upper eyelid.
K. Inferior oblique muscle.
K′. Reflected portion or orbital tendon of the inferior oblique.
L. Aponeurotic expansion between the internal and inferior recti muscles of the eye.
M. Aponeurotic fascia of the inferior rectus passing to unite with the tendon of the internal rectus.
N. Aponeurotic fascia uniting the internal rectus, superior rectus and elevator muscle of the upper eyelid.
O. Aponeurotic fascia uniting with the orbital tendon of the internal rectus and coming from the superior rectus muscle.
O′. Opening for the passage of the frontal nerves (5th pair).
O″. Orifice for the passage of the nasal branches of the ophthalmic artery.
P. Aponeurotic fascia uniting the external and superior recti muscles.
Q. Aponeurotic fascia uniting the external and inferior recti muscles and the inferior oblique.
R, R, R, R. Periosteum of the orbit.
S. Cavity for the reception of the lachrymal gland.
S′. Opening for the passage of the lachrymal ducts and of some branches of nerves and vessels passing into the substance of the upper eyelid.
T. Space filled with fat and forming the upper part of the orbital canal which establishes a communication between the orbit and the subcutaneous cellular tissue of the external portion of the upper eyelid.
U. Small fibrous fascia uniting the periosteum of the orbit with the aponeurotic expansion of the elevator muscle of the upper lid, of the superior rectus muscle, and of the superior and inferior recti muscles.
U′. Opening for the passage of the supra-orbital vessels and nerves.

V. Lachrymal canal.
V′. Inferior valve of the lachrymal sac.
V″. Valve in the central portion of the lachrymal canal.
V‴. Inferior valve of the lachrymal canal.
X. Optic nerve with its sheath.
Z. Ocular aponeurosis covering the posterior surface of the globe of the eye.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

If all the tendons of the muscles of the eye are divided, movements will still be communicated to the globe of the eye, by means of the tendons passing to the eyelids, and by the expansions which their muscles transmit in return. We here find a verification of that law of diffusion by which every action is prevented from being under the exclusive control of any single organ. If the internal rectus is divided and abduction of the eye still continues, although to a very slight extent, it is produced by the expansions of the superior and inferior recti muscles.

The aponeurotic expansions which unite the superior rectus and the elevator of the upper eyelid explain the conjoint elevation of the pupil and of the upper eyelid, and also the continuance of a slight movement of elevation of the globe of the eye when the superior rectus has been divided.

Figure 2. — Region of the Orbit.

The aponeurotic expansions and orbital insertions of the muscles of the eye.

EXPLANATION.

A. Elevator muscle of the upper eyelid.
A′. Aponeurotic expansion of the tendon of the muscle passing to be inserted into the inner wall of the orbit.
B. Section of the superior rectus muscle.
B′. Aponeurotic expansion uniting the tendon of this muscle to the tendon of the external rectus.
C. Section of the external rectus muscle.
C′. Aponeurotic expansion of the tendon of this muscle uniting it to the superior rectus.
C″. Aponeurotic expansion of the same muscle passing to the inferior rectus and to the inferior oblique.
D. Section of the inferior rectus muscle whose tendon is traversed by some of the fibres of the inferior oblique muscle.
D′. Aponeurotic expansion uniting the superior rectus, the inferior oblique, and the external rectus.
E. Section of the internal rectus near to its tendon.
E′. Small tendinous fasciculi of this muscle passing to unite to a similar fasciculus, coming from the inferior rectus.
F. Inferior oblique muscle giving at its origin an aponeurotic expansion to the fibrous capsule of the eye.
F′. Orbital insertion of the inferior oblique muscle.
F″. Ocular insertion of the same muscle.
G. Section of the superior oblique near its passage through its pulley of reflection.
G′. Insertion of the superior oblique on the posterior part of the sclerotic.
H. Section of the fibrous capsule of the eye showing the insertion of the superior oblique muscle.
H′. Section of the same capsule showing the insertion of the inferior oblique.
I. Globe of the eye and the sclerotic.

FIG. 1

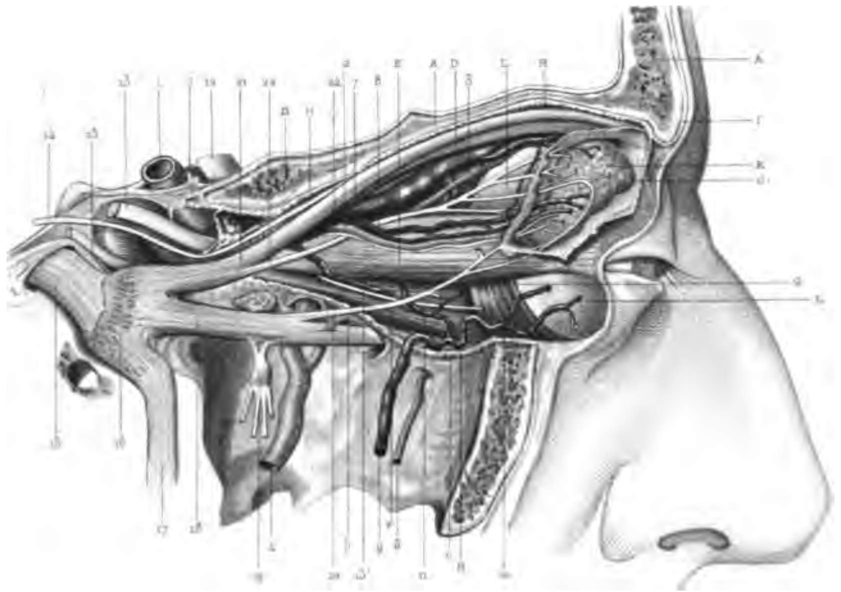
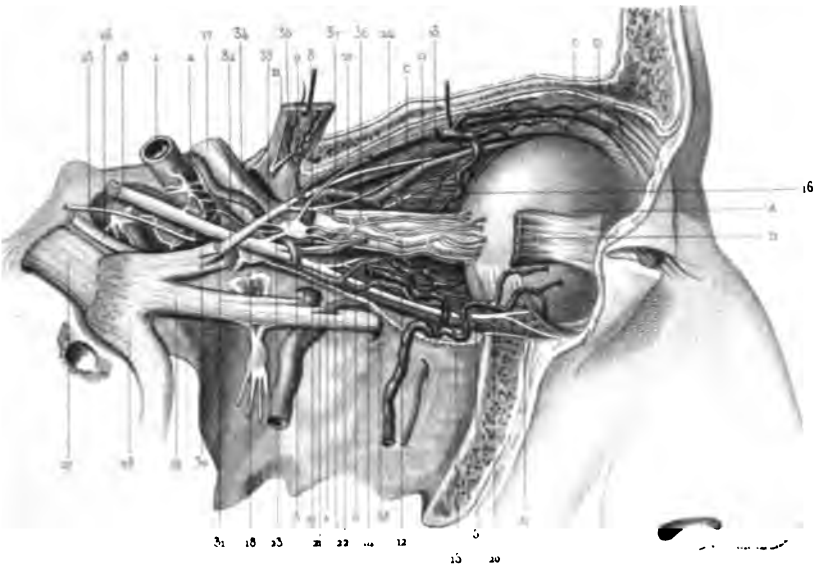


FIG. 2



LIBRAIRIE GERMER BAILLIÈRE

PLATE XIV.

Figure 1. — Region of the Orbit.

Internal surface.

EXPLANATION.

A. Section of the frontal bone.
B. Frontal sinus.
C. Internal surface of the external wall of the nose.
D. Maxillary sinus.
E. Sphenoidal sinus.
F. Opening into the lachrymal sac of the lachrymal ducts bounded by the circular valve, called the *valve of Huschke*.
G. Inferior valve of the lachrymal sac, called the *valve of Béraud*.
H. Middle valve of the nasal duct, called the *valve of Taillefer*.
I. Inferior valve of the nasal duct, called the *valve of Cruveilhier*.
K. Globe of the eye.
L Elevator muscle of the upper eyelid.
M. Superior rectus muscle.
N. Internal rectus muscle divided.
O. Superior oblique muscle.
P. Fibrous ring traversed by the reflected tendon of the superior oblique muscle.

1. Internal branch of the ophthalmic artery.

2. Ophthalmic vein receiving the branches which come from the upper eyelid and from the internal surface of the globe of the eye.
3. Branch of the ophthalmic vein coming from the internal surface of the globe of the eye.

4. Optic nerve.
5. Ophthalmic nerve.
6. Nasal branch of the ophthalmic nerve.
7. Ciliary nerve coming from the nasal branch of the ophthalmic.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The internal rectus muscle occasionally turns the globe of the eye so that the pupil looks inwards: this condition constitutes internal or convergent strabismus. The division of the internal rectus is sometimes indicated as the cure for this form of strabismus. This operation has been performed in various ways, amongst which we may mention those of M.M. Stromeyer, Velpeau, J. Guérin and L. Boyer. Whatever plan is adopted, certain preliminary steps are always requisite, such as steadying the head by assistants, placing a bandage over the sound eye, drawing the eye to be operated on outwards, and separating the eyelids by means of the retractor. M. Velpeau's plan is the one we prefer. It consists in seizing at the same time the conjunctiva and the muscle and its aponeurosis with a pair of toothed forceps, whose blades cannot be brought in contact One of the blades is placed near the sclerotic and the other further back, taking care to include as much of the parts as possible between the two, and then dividing with the scissors the portion that has been taken up. This operation has the advantage of being equally rapid as the others.

Figure 2. — Region of the Orbit.

The Aponeuroses.

EXPLANATION.

A. Section of the skin of the eyelids.
B. Section of the orbicular muscle.
C. Section of the subcutaneous fascia.
D. Section of the frontal bone.
E. Section of the superior maxillary bone.
F. Section of the cartilage of the upper eyelid.
G. Section of the cartilage of the lower eyelid.
H. Section of the periosteum of the inferior margin of the orbit continuous with the periosteum of the orbit.
I. Section of the palpebral aponeurosis.
J. Section of the periosteum of the orbit.
K. Section of the aponeurosis which unites in the upper eyelid the palpebral aponeurosis to the sheath of the superior rectus muscle, and in the lower eyelid the palpebral aponeurosis to the sheath of the inferior rectus muscle.
L, M. Section of the aponeurotic sheath of the inferior rectus.
L′, M′. Section of the aponeurotic sheath of the superior rectus muscle.
O. Section of the aponeurotic layer situated on the globe of the eye, the ocular portion of the orbito-ocular aponeurosis.
P. Globe of the eye
Q. Superior rectus covered by its aponeurotic sheath.
R. Inferior rectus covered by its aponeurotic sheath.
S. Aponeurosis or rather periosteum of the orbit, which covers the bones of the orbital cavity.
T. Prolongation of the dura mater in the posterior palatine canal.
V. Maxillary sinus.

1. Optic nerve covered by its fibrous sheath which is continuous posteriorly with the dura mater and anteriorly with the sclerotic.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The various prolongations of the aponeurosis of the orbit to the eyelids and to the globe of the eye readily account for the accordance which exists between the movements of the eyelids and those of the eye. The aponeurotic expansions of the tendons of the recti and oblique muscles, notwithstanding the division of their tendons, or even of the muscles themselves, prevent the two extremities from separating to the extent that would at first be supposed. It is these aponeurotic expansions which sometimes necessitate a complementary division of the muscle in the operation

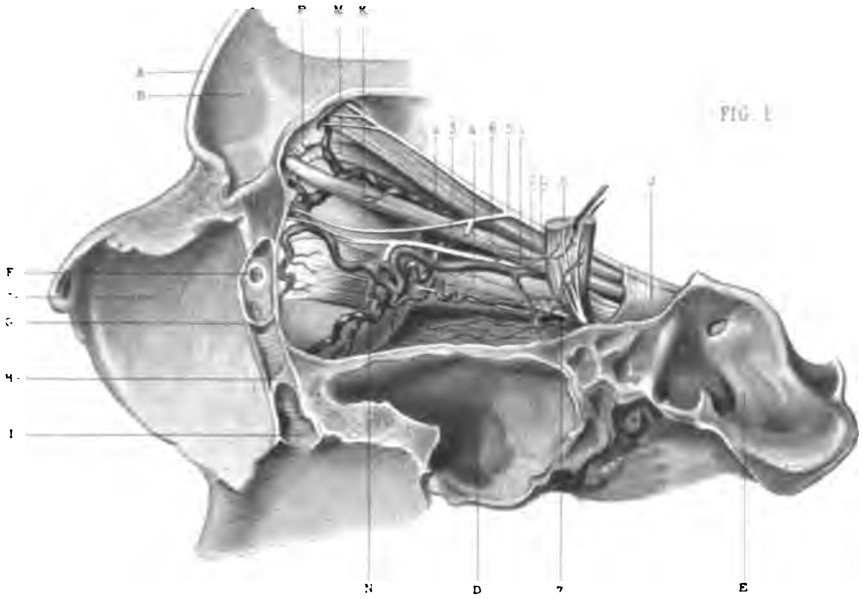


FIG. 1

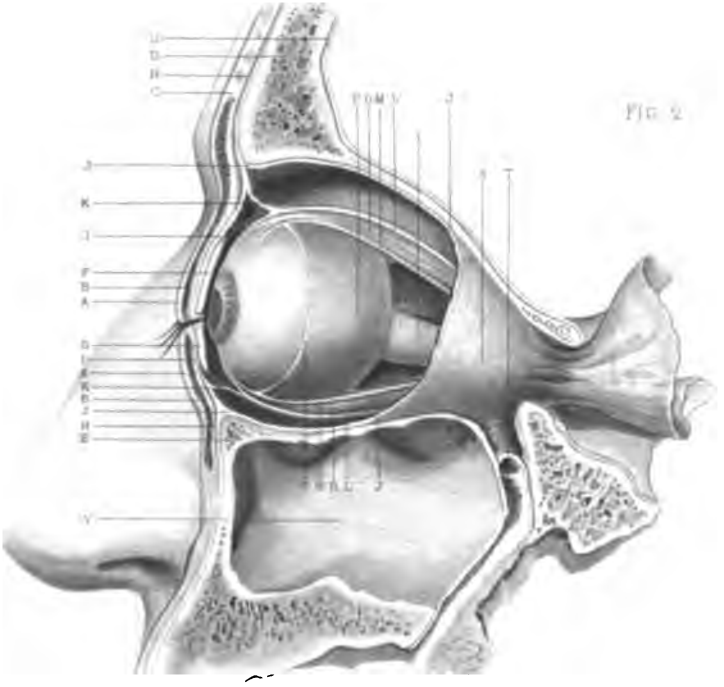


FIG. 2

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PLATE XV.

FIGURE 1. — **Region of the Orbit.**

Orbital canal.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Fibres of the occipito-frontalis muscle interlacing with those of the orbicularis palpebrarum.
D. Section of the fibres of the orbicularis palpebrarum.
E. Portion of the orbicular muscle turned outwards.
E'. Temporal muscle.
F. Section of the frontal bone.
G. Section of the periosteum of the frontal bone.
H. Section of the aponeurosis of the orbit.
I. The lachrymal gland.
J. The palpebral aponeurosis forming the anterior wall of the orbital canal.
K. External orifice of the orbital canal.
L. Orifice of the canal traversing the orbicular muscle of the eyelids.
M. Filament of the lachrymal nerve passing through this canal to be distributed to the skin.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The canal which we have named the *orbital canal* is to the cavity of the orbit what the crural canal or the inguinal canal is to the cavity of the abdomen. It gives passage to vessels and nerves. It thus forms a communication between the interior of the orbit and the subcutaneous cellular tissue. If blood is extravasated into the substance of the eyelid above the palpebral aponeurosis it will make its way to the surface on this side. If an abscess forms in the orbit, the pus has a tendency to obtain an exit by this canal, and this in fact is what is seen in practice without our being able to account for it. It follows therefore that an abscess in the orbit should be opened opposite the external orifice of this canal.

FIGURE 2. — **Region of the Orbit.**

Orbito-ocular aponeurosis.

EXPLANATION.

A. Margin of the orbit.
B. Lachrymal canal.
C. Hooks stretching the ocular aponeurosis.
E. Section of the superior rectus muscle passing through the ocular aponeurosis.
F. Section of the inferior rectus muscle passing through the ocular aponeurosis.
G. Section of the internal rectus muscle passing through the ocular aponeurosis.
H. Section of the external rectus muscle passing through the ocular aponeurosis.
I. Section of the inferior oblique muscle passing through the ocular aponeurosis.
I'. The insertion of the inferior oblique muscle into the margin of the orbit.
J. The superior oblique muscle.
K. Pulley for the reflected tendon of the superior oblique muscle.
L. Tendon of the superior oblique muscle after it has passed through the ocular aponeurosis.
1. The optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This portion of the aponeurosis shows how the globe of the eye is, so to speak, separated from the orbital cavity. In extirpation of the eye, if care is taken not to injure the barrier formed by this fibrous membrane, the operation is far less dangerous than if it is perforated, because then the soft parts of the orbit become inflamed and suppurate, and may thus propagate the inflammation and suppuration to the cranial cavity. By preserving this aponeurosis, there is the further advantage of having a support upon which it is more easy to adapt an artificial eye.

To accomplish this, we must proceed in the following manner: the conjunctiva is first to be divided at its inner portion, and the internal rectus cut through; then, by means of the scissors, we successively divide the superior rectus, the external rectus, the superior oblique, the inferior rectus, and the inferior oblique muscles near to their insertions, and terminate the operation by dividing the optic nerve close to the eye.

FIGURE 3. — **Region of the Orbit.**

Insertion of the recti muscles on the globe of the eye.

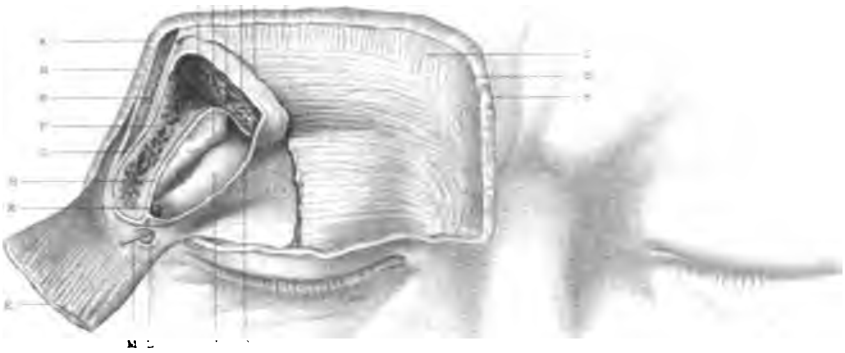
EXPLANATION.

A. Tendon of the superior rectus inserted into the sclerotic.
B. Tendon of the inferior rectus inserted into the sclerotic nearer to the cornea than the superior rectus.
C. Tendon of the internal rectus inserted into the sclerotic.
D. Tendon of the external rectus stronger than the preceding and inserted farther from the circumference of the cornea than the internal rectus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The tendon of the internal rectus muscle is the one which is inserted nearest to the circumference of the cornea, and is also the one most easily divided. The ocular portion of all the tendons of the muscles of the eye are intimately attached to the sclerotic for a certain space and are expanded over the globe of the eye, as it were over a pulley of reflexion; so that when they are divided they must be carefully raised by means of a blunt hook to avoid wounding the sclerotic or even opening the eye. Opposite each tendon, the globe of the eye presents a depression so that it has somewhat of a quadrangular form. This arrangement is especially distinct when the globe of the eye is distended by an accumulation of the vitreous humour, for instance, or from any other cause.

FIG. 1



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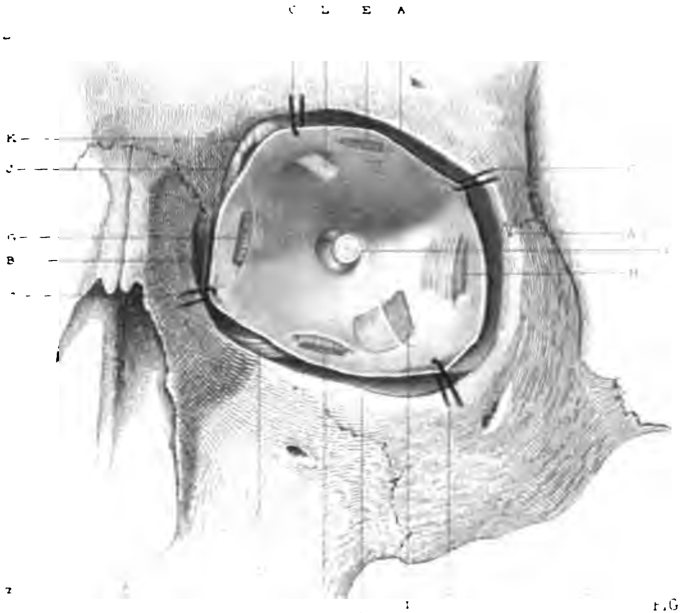

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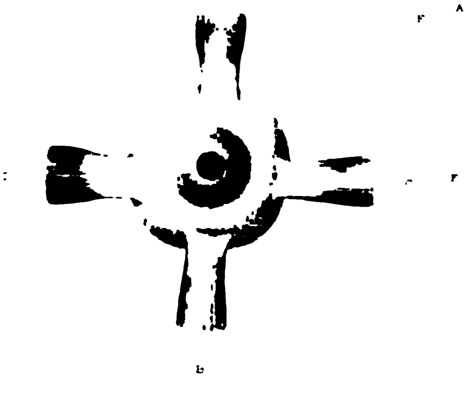

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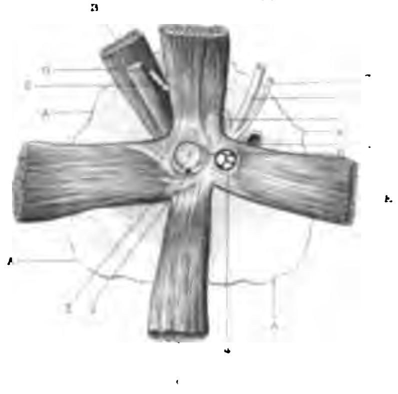

LIBRAIRIE GERMER BAILLIERE

PLATE XVIII.

Figure 1. — Region of the Eye.

EXPLANATION.

A. Section of the conjunctiva.
B. The sclerotic.
C. The cornea.
D. The pupil.
E. Section of the superior rectus muscle.
F. Inferior rectus muscle.

G. External rectus muscle.
H. Inferior oblique muscle.
I. Tendinous insertion of the superior oblique muscle.
1. Ophthalmic artery.

2. Ophthalmic vein.
3. Optic nerve.
4. Ophthalmic nerve.
5. Motor nerve of the eye.
6. The ophthalmic or lenticular ganglion giving rise to the ciliary nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The sclerotic, which is the protecting membrane of the eye, and preserves its form, presents a thinning posteriorly that favours the production at this point of posterior staphyloma, which no doubt depends upon chronic choroiditis. Strong and resisting, this membrane is liable to contusions and wounds. Penetrating wounds are serious, because they may be accompanied with a discharge of blood into the midst of the eye, or on the exterior of it, and be followed by a hernia of the intra-ocular membranes and fluids. The existence of sub-conjunctival ecchymosis which occurs in these wounds renders the diagnosis difficult.

Wounds of the cornea are not followed by hæmorrhage, but they allow of the escape of the aqueous humour, and if the iris did not prevent its exit in proportion as the fluid is reproduced, the chambers would be continually emptied. The case of the eye formed by the sclerotic and the cornea has very little power of extension, so that diseases of the interior of the eye which tend rapidly to increase the size of the organ are extremely painful, and often require the constriction to be relieved by puncturing.

The sclerotic and the cornea being resisting, it follows that if they are wounded, there will be, at the same time, derangement of the more delicate parts which they protect, so that the whole of the danger does not depend upon the wounding of the two membranes, but also upon the injuries which arise from the greater or less disturbance of the subjacent membranes.

Figure 2. — Region of the Eye.

EXPLANATION.

A. Section of the sclerotic.
B. Section of the cornea.
C. Section of the sheath of the optic nerve.
D. The anterior chamber.

E. The iris.
F. The pupil.
G. Ciliary ligament.
H. The choroid.

1. The long ciliary arteries.
1'. Section of the anterior ciliary arteries.
2. The optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The cornea consists of three layers, each of which may be inflamed separately, hence the expressions of ***superficial***, ***interstitial*** and ***deep keratitis***. These various kinds of inflammation, like the wounds of the cornea, may leave behind them opacities more or less extensive, and the more serious in proportion to their nearness to the centre of the cornea. For the purpose of removing these opacities it has been proposed to abrade or partially scrape off the surface of the cornea, or even to operate for artificial pupil. When the cornea is inflamed, a red circle seen around its circumference, termed the ***arthritic ring***, formed by the vessels which terminate at this part.

Figure 3. — Region of the Eye.

EXPLANATION.

A. Section of the sclerotic.
B. Section of the sheath of the optic nerve.
C. Section of the cornea.
D. Internal or concave surface of the choroid.
E. Section of the choroid.
F. Ciliary processes of the choroid.
G. Section of the iris.

H. The pupil.
I. The anterior chamber.
J. Internal or concave surface of the retina.
K. Section of the retina through its antero-posterior circumference.
L. Section of the retina through its transverse circumference.

1. The centralis retinæ artery.
2. The choroid arteries.
3. Section of the venous canal.
4. Section of the optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The choroid presents many alterations connected with its pigmental and vascular structures. The ophthalmoscope has partially removed the curtain which concealed these alterations from us. Amongst those which have been recently investigated, we may mention those of chronic choroiditis. As regards the pigmental layer, there may be absence of the colouring matter constituting albinism, or there may be too much colouring matter, and this may be distributed either irregularly, or uniformly. Certain inflammations are followed by atrophy, or displacement of the colouring matter.

The vascular layer may present the condition of anœmia, hyperæmia, or apoplexy, and the formation of a dermal tissue furnished with hairs.

Figure 4. — Region of the Eye.

A. Section of the sclerotic.
B. Section of the sheath of the optic nerve.
C. Section of the cornea.
D. The anterior chamber.

E. The iris.
F. The pupil.
G. The ciliary ligament.

1. Venous trunks divided receiving the venous branches of the choroid.
2. The optic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The veins of the choroid, or *vasa vorticosa*, traverse the sclerotic in an oblique direction, and as they are sometimes the seat of varicose dilitations, they render the sclerotic less resisting, and it is, no doubt, in consequence of this, that we meet with staphyloma at their point of emergence. It is probable that the pains and feeling of constriction which characterise choroiditis are owing to inflammation of these veins which are much dilated.

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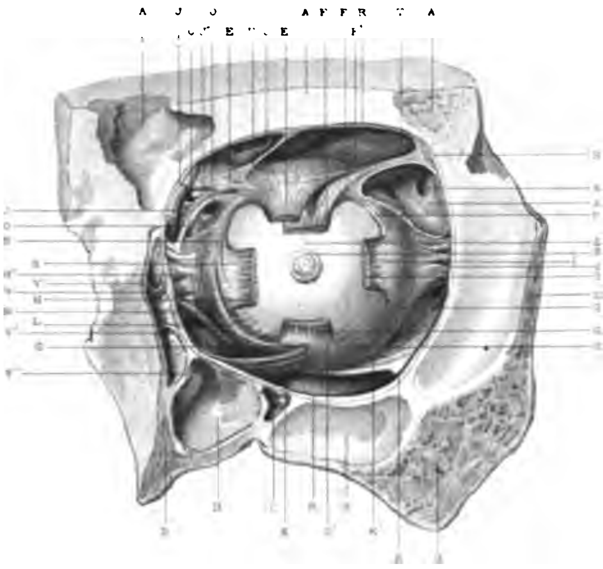

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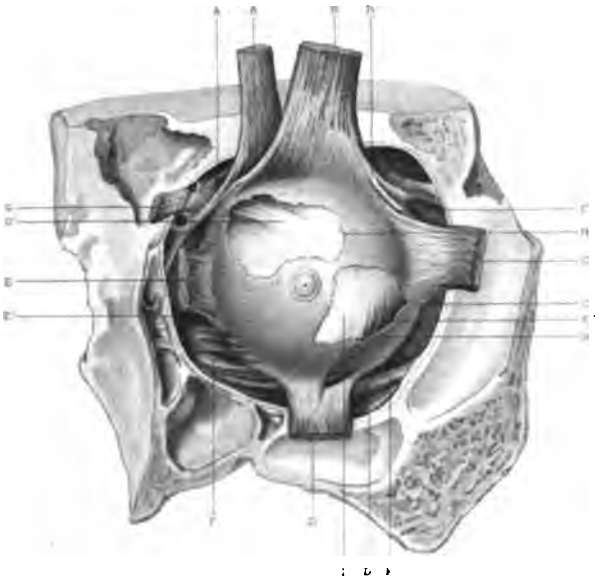
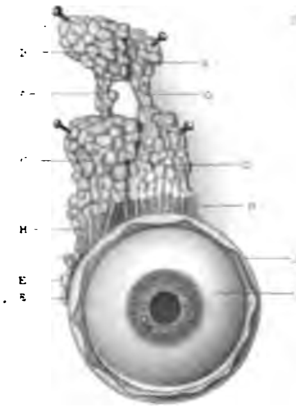


LIBRAIRIE GERMER BAILLIÈRE

FIG 1



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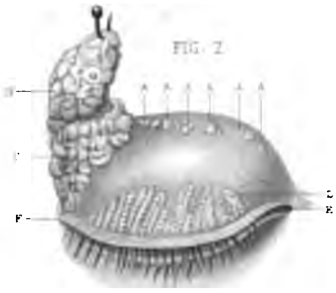

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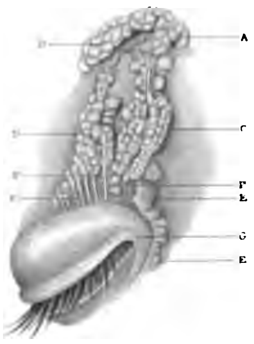

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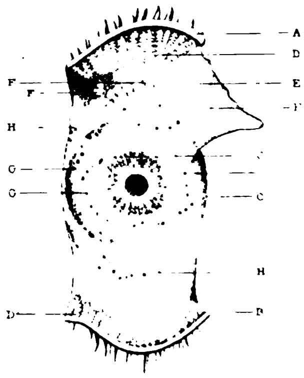

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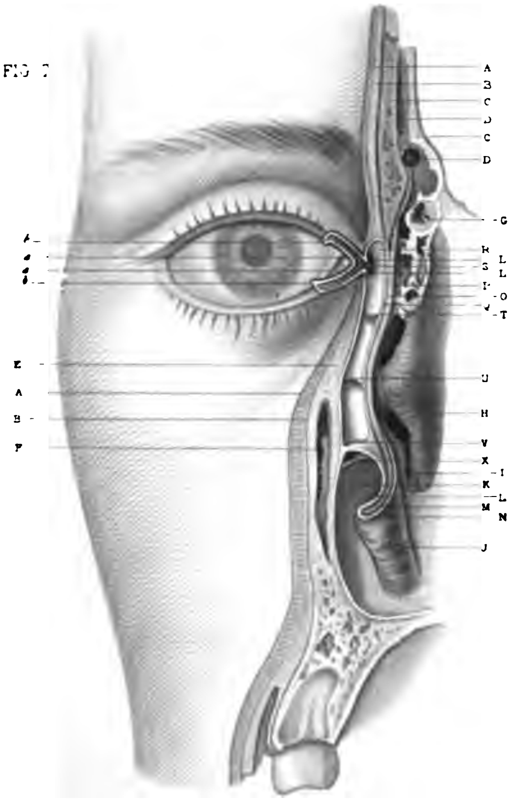

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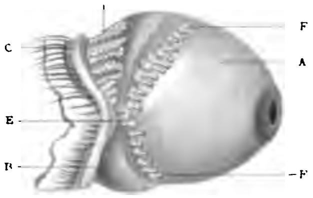

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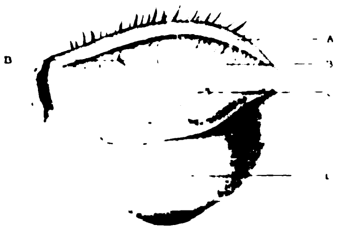


LIBRAIRIE GERMER BAILLIERE

PLATE XIX.

FIGURE 1. — **Orbital Region.**

External wall of the orbit.

EXPLANATION.

A. Section of the frontal bone.
B. Superior and external portion of the orbit formed by the frontal bone.
C. Section of the process of Ingrassias.
D. Superior portion of the maxillary bone forming the floor of the orbit.
E. Section of the superior maxillary bone.
F. Internal surface of the malar bone forming part of the orbit.
G. Portion of the great wing of the sphenoid which assists in forming the outer wall of the orbit.
H. Suture between the frontal and malar bones.
I. Suture between the sphenoid and frontal bones.
J. Suture between the sphenoid and malar bones.
K. Suture between the maxillary and malar bones.
L. The spheno-maxillary fissure.
M, N, O. Openings giving passage to vessels and nerves.
P. Sphenoidal fissure.
Q. The maxillary sinus.
R. The sphenoidal sinus.
S. Section of the superior portion of the palate bone.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The walls of the orbit offer a resistance to external violence proportioned to their liability to these injuries. The external wall being the one most liable to blows, is also the one which has the greatest thickness. The internal wall being deeply seated is the most fragile, and for this reason even blunt substances may fracture it and reach the internal carotid (case by M. Nélaton). The superior wall of the orbit is thicker than the inferior.

FIGURE 2. — **Orbital region.**

Internal wall of the orbit.

EXPLANATION.

A. Section of the frontal bone,
B. Portion of the frontal bone forming the superior and internal wall of the orbit.
C. Section of the sphenoid bone.
D. Portion of the superior maxillary bone forming the floor of the orbit.
E. Section of the superior maxillary bone.
F. Orbital surface of the ethmoid.
G. Section of the ethmoid.
H. Lachrymal bone.
I. Suture between the lachrymal and ethmoid bones.
J. Suture between the frontal and lachrymal bones.
K. Suture between the superior maxillary and the lachrymal bones.
L. Suture between the ethmoid and superior maxillary bones.
M. Suture between the sphenoid and ethmoid bones.
N. Suture between the ethmoid and frontal bones.
O. Opening through which an artery passes.
P. Opening through which a nerve passes.
Q. Suture between the superior maxillary and lachrymal bones.
R. Suture between the ascending process of the superior maxillary and the frontal bones.
S. Groove of the lachrymal canal.
T. Opening for the passage of the optic nerve.
U. Sphenoidal fissure.
V. The maxillary sinus.
X. The sphenoidal sinus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Fractures of either of the walls of the orbit are not only important in themselves but also in consequence of the lesions which accompany them. Thus the displaced particles of bone may cause compression of an artery, or of a nerve or of some other important organ, thereby producing serious disturbance in the function of vision. When the external injury is sufficiently violent to cause fracture there is necessarily more or less concussion of the encephalic organs or of the globe of the eye, giving rise to very serious complications.

The orbit is the seat of various kinds of tumours which may be connected with the bones, as in periostitis and exostosis, or with the soft parts, as in the case of aneurisms, erectile tumours, cysts and cancers.

All these tumours originate in the orbit, and as they become developed they reach the neighbouring cavities, should they originate in these cavities, then they afterwards extend into the orbit. The relations of the region readily explain why a tumour of the orbit may send prolongations into the maxillary sinus, the nasal fossæ, the frontal sinuses, the cranium, or the temporal fossæ.

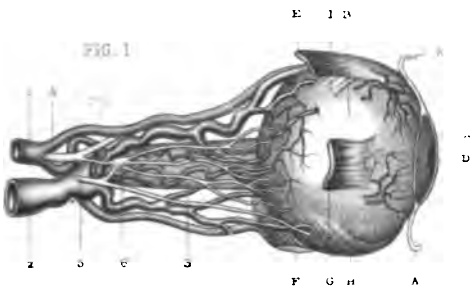
All these tumours possess certain characters in common, depending upon the conformation of the orbital cavity, and may be divided into three periods.

During the first period, there are pains at the bottom of the orbit, and some ill-defined functional derangements, which are but of little use for the purpose of diagnosis.

In the second period the eye begins to be displaced. If exopthalmia exists, the tumour is most probably situated behind the eye; if it is displaced inwards, then the tumour occupies the external side.

In the third period the tumour appears externally where the surgeon can make a direct examination of it.

FIG. 1



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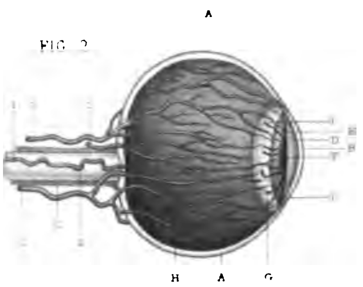

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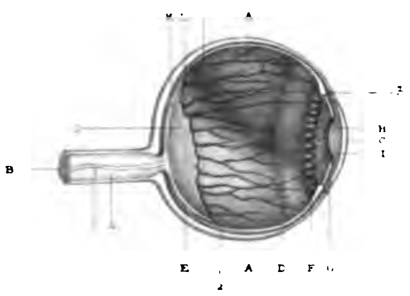

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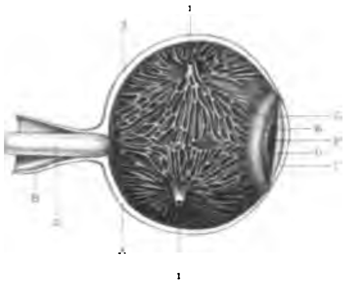

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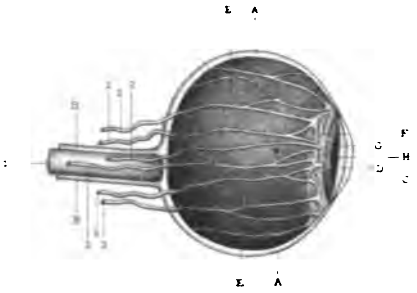

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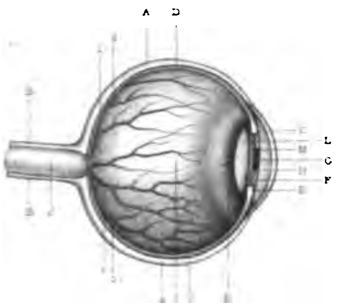

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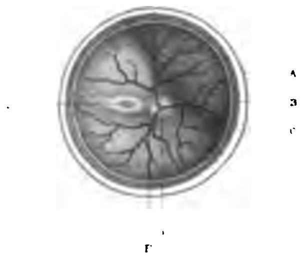

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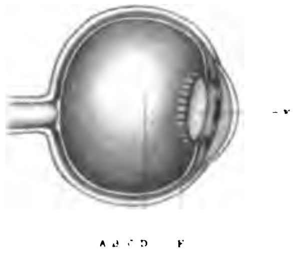

PLATE XIX.

FIGURE 1. — Orbital Region.

External wall of the orbit.

EXPLANATION.

A. Section of the frontal bone.
B. Superior and external portion of the orbit formed by the frontal bone.
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D. Superior portion of the maxillary bone forming the floor of the orbit.
E. Section of the superior maxillary bone.
F. Internal surface of the malar bone forming part of the orbit.
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FIGURE 2. — Orbital region.

Internal wall of the orbit.

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J. Suture between the frontal and lachrymal bones.
K. Suture between the superior maxillary and the lachrymal bones.
L. Suture between the ethmoid and superior maxillary bones.
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N. Suture between the ethmoid and frontal bones.
O. Opening through which an artery passes.
P. Opening through which a nerve passes.
Q. Suture between the superior maxillary and lachrymal bones.
R. Suture between the ascending process of the superior maxillary and the frontal bones.
S. Groove of the lachrymal canal.
T. Opening for the passage of the optic nerve.
U. Sphenoidal fissure.
V. The maxillary sinus.
X. The sphenoidal sinus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

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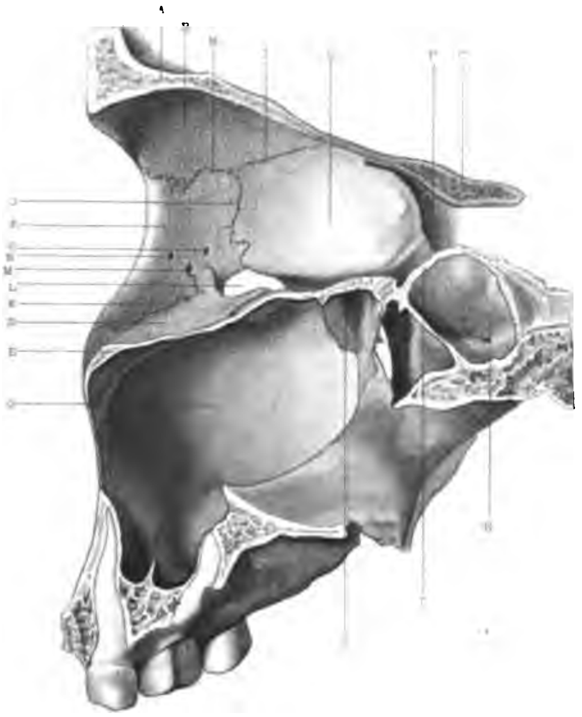


FIG 1

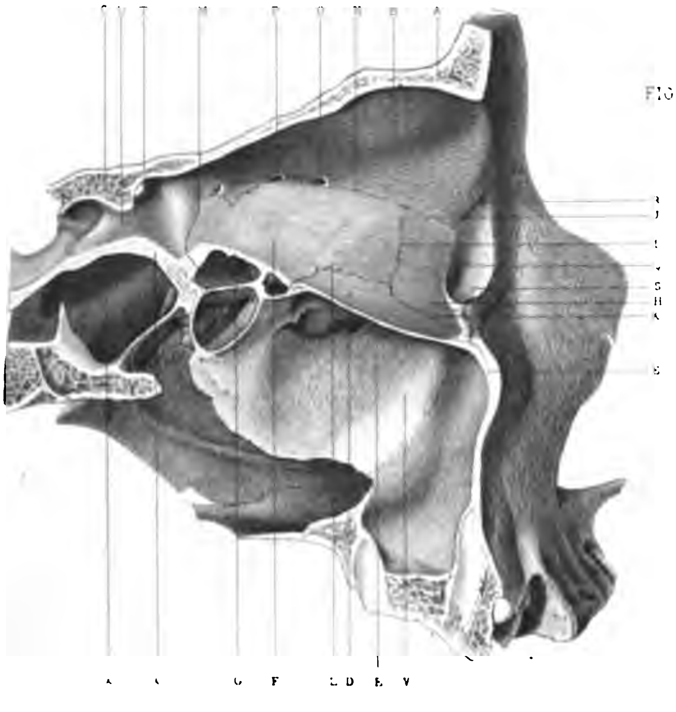


FIG 2

LIBRAIRIE GERMER BAILLIÈRE

PLATE XX.

Figure 1. — **Nasal Region.**

EXPLANATION.

A. Section of the skin and the subcutaneous fascia.
B. Elevator muscle of the ala of the nose.
C. Transverse muscle of the nose.
D. The compressor naris.
E. Fibres of the orbicular muscle of the lips.

1. The nasal artery, a branch of the ophthalmic.
2. Artery coming from the coronary of the lips and anastomising with the nasal.
3. Branch of the coronary of the upper lip going to the cavity of the nose.
4. Another arterial branch coming from the superior coronary.
5. The angular vein.
6. Facial vein.
7. Coronary vein of the upper lip.
8. 9. Veins of the nose emptying themselves into the angular vein.

10, 11, 12, 13, 14. Lymphatic vessels.

15, 16. Nerves going to the lobe of the nose.
17, 18. Terminal branches of the external nasal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The large number of vessels and nerves belonging to this region explain why wounds of it are so painful, and are frequently followed by a considerable loss of blood. The application of a suture to the wound is often sufficient to arrest the hæmorrhage. The bones of the nose are prominent and exposed to fractures which impede respiration and produce a deformity that it is sometimes necessary to remedy. Fractures and wounds are often accompanied by ecchymosis and emphysema which then render the diagnosis difficult.

Caries, necrosis, acne, hypertrophy of the different tissues, syphilitic and scrofulous ulcers, cancers and erectile tumours often affect the nose, all this is explained by the structure of the region.

The nose is the seat of malformations, such as flattening, being too large, flattening of the root, bending either to the right or to the left.

Rhinoraphy is intended to re-unite by means of a suture the parts that have been divided; it is used in the case of a recent wound, or to remedy a deformity arising from some previous lesion.

Rhinoplasty is an operation for the restoration of a part or of the whole of the nose. Complete rhinoplasty performed after the Italian, French, or Indian methods has not afforded satisfactory results. According to M. Nélaton this operation should fulfil the following indications. 1st. By means of flaps taken from the neighbouring parts it should reconstruct a well formed and projecting nose. 2nd. It should prevent any subsequent deformity. The first condition is easily fulfilled whatever plan is pursued; but it is not the same with regard to the second. M. Nélaton was the first who took care to dissect off the periosteum so as to leave it attached to the deep surface of the flaps, (*Société de Chirurgie*, 1862, p. 109). By dissecting off two lateral flaps and a frontal flap, arranging them over the part, preserving the periosteum, and putting the bones in a proper position, a successful result may be obtained, and the subsequent falling in of the flaps prevented.

Partial rhinoplasty is intended to remedy deformities of the lobes, alæ and nostrils, or of the parts situated between the root and alæ of the nose. This operation is attended with favourable results, and we have ourselves succeeded in one case in restoring the whole of the left side of the nose which had been destroyed by cancer. M. Michon in his operations at La Pitié has shown the very successful results which may be obtained by the Indian method.

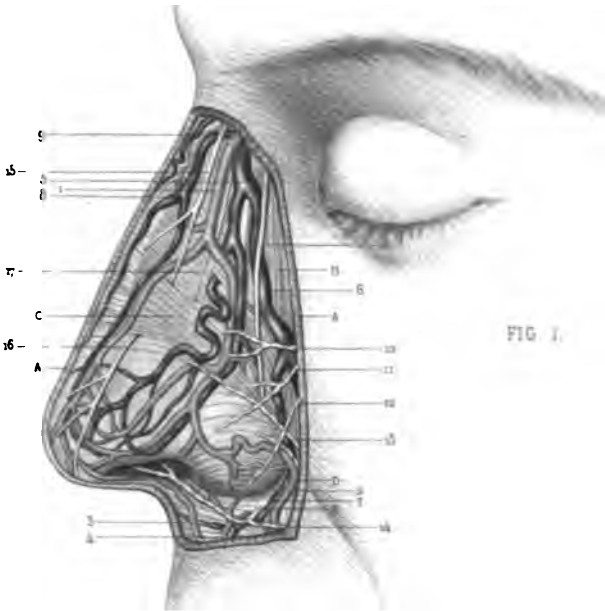
Figure 2. — **Region of the Nasal Fossæ.**

External Wall.

EXPLANATION.

A. Section of the skin.
B. Section of the cellular layer containing the fibres of the pyramidalis nasi muscle.
C. Section of the frontal bone.
D. Section of the nasal bone.
E. Section of the superior maxillary bone.
F. Section of the body of the sphenoid.
G. The sphenoidal sinus.
H. Section of the right lateral cartilage.
I. Section of the cartilage of the ala of the nose.
K. Section of the dura mater.
L. Section of the mucous membrane of the nasal fossæ.
M. Section of the mucous membrane of the gums.
N. Section of the mucous membrane of the arch of the palate and of the velum.
O. Section of the mucous membrane of the pharynx and velum.
P. Section of the muscular layer of the velum.
Q. Section through the glands of the velum palati.
R. Section of the posterior wall of the pharynx.
S. Vestibule of the oral cavity.
T. Pharyngeal opening of the Eustachian tube.

1. Inferior meatus.
2. Section of the inferior spongy bone.
3. Bristle introduced into the nasal canal.
4. Middle meatus.
5. Section of the middle spongy bone.
6. Inferior orifice of the maxillary sinus opening into the infundibulum.
7. Superior orifice of the same sinus.
8. Inferior and posterior orifice of the ethmoidal cells opening behind the infundibulum.
9. Superior and posterior opening of these cells.
10. Opening of the frontal sinus into the infundibulum.
11. Superior spongy bones.
12. Aperture of the ethmoidal cells opening into the superior meatus.
13. Bristle introduced into an opening which forms a communication between the anterior ethmoidal cells and the superior meatus.
14. Second superior meatus in which is seen the orifice of one of the ethmoidal cells.
15. Bristle introduced into the opening which forms a communication between the ethmoidal sinus and the nasal fossæ.



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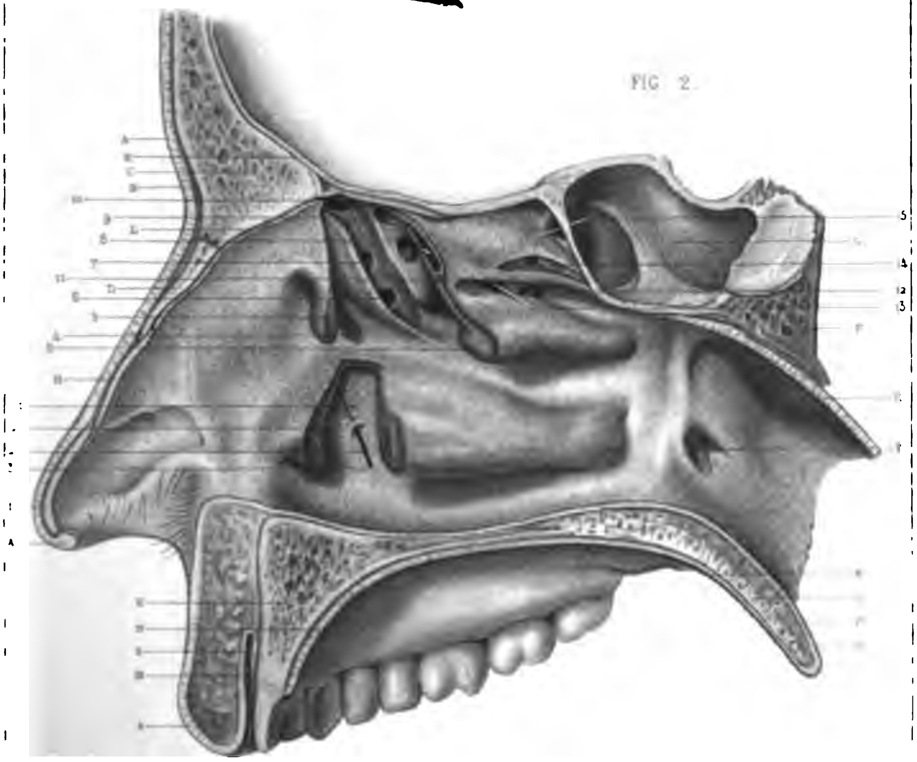
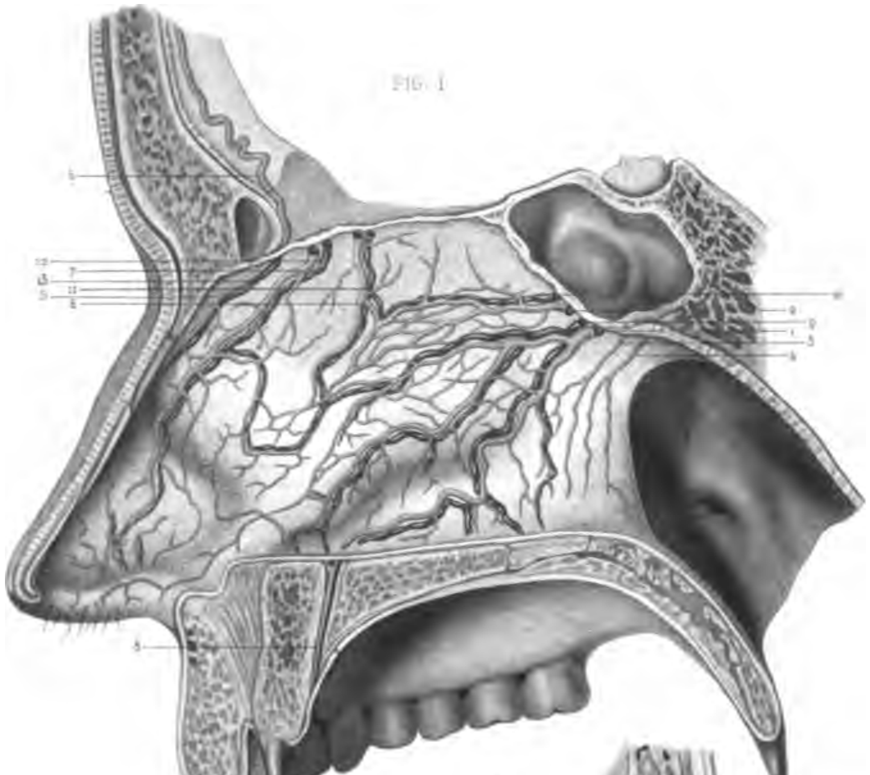


FIG. 2.

LIBRAIRIE GERMER BAILLIERE

FIG. 1



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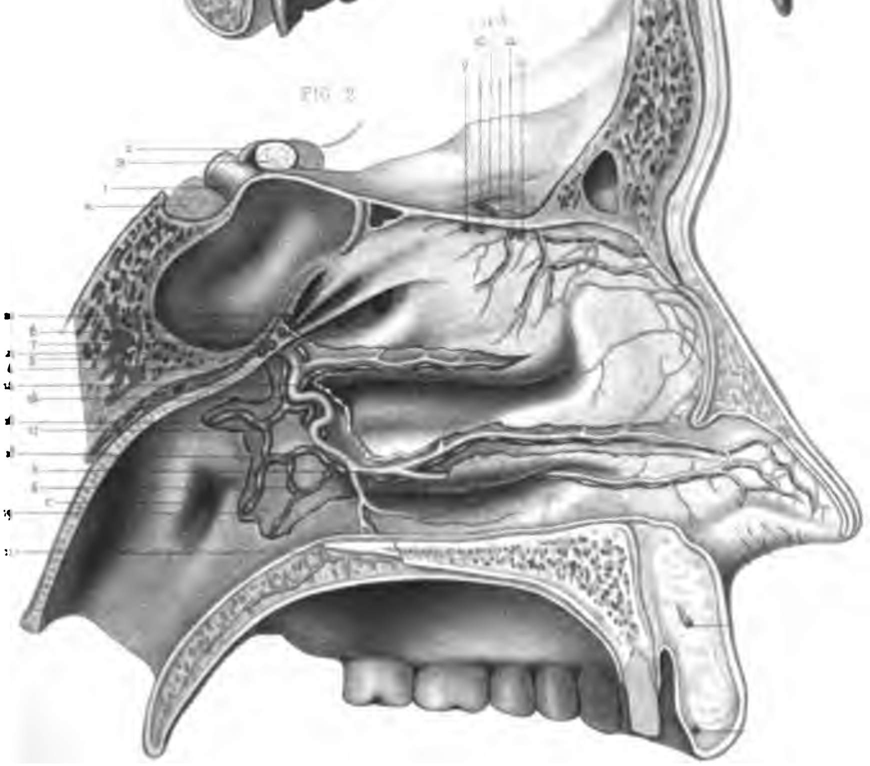


LIBRAIRIE GERMER BAILLIÈRE

PLATE XXIV.

Parotid Region.

The deep relations of the parotid gland.

EXPLANATION.

A. Section of the skin, the subcutaneous fascia and fat.
B. Section through the median line of the sphenoid bone.
C. Oblique section from before backwards and from within outwards of the occipital bone.
D. Opening giving passage to the external motor nerve of the eye (6th pair).
E. Opening for the 5th pair of nerves.
F. Opening giving passage to the facial and auditory nerve.
G. Foramen lacerum posterius enclosing the glosso-pharyngeal, pneumogastric and spinal nerves.
H. Section of the lateral sinus at its inferior extremity.
I. Section of the same sinus above.
J. Section of the posterior wall of the pharynx.
K. Section of the trapezius muscle.
L. Section of the splenius muscle.
M. Section of small complexus muscle.
N. Degastric muscle covered by its aponeurosis.
O. Stylo hyoideus muscle at its insertion into the posterior part of the styloid process.
P. The stylo pharyngeus and stylo-glossus muscles covered by their aponeuroses.
Q. Aponeurosis covering the digastric muscle.
R. Section of the aponeurosis.
S. Lobules of the parotid gland.
T. Posterior surface of the posterior wall of the pharynx.

1. Common carotid artery.
2. External carotid artery.
3. Occipital artery.
4. Auricular artery.
5. Stylo-mastoid artery.
6. Superior pharyngeal artery.
7. Internal carotid artery.
8. Branch of the superior thyroid artery going to the sterno-cleido mastoideus and trapezius muscles.

9. Internal jugular vein.
10. Large vein forming a communication between the internal and external jugular veins.
11. Occipital vein entering the internal jugular.
12. Superior thyroid vein joining the internal jugular.
13. Section of the internal jugular vein.
14. Section of the inferior pharyngeal vein.

15. Glosso-pharyngeal nerve.
16. Pneumo-gastric nerve.
17. Superior laryngeal nerve.
18. Spinal nerve.
19. Great sympathetic nerve.
20. Facial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This plate shows the dangers which threaten the surgeon who attempts the entire removal of the parotid gland and who has penetrated to the bottom of the parotid space. It is evident that the external carotid and the majority of its lateral and terminal branches are situated in the same space as the gland, and that it is therefore difficult to avoid them. It is the same with regard to the facial nerve. The bottom of this space is separated by a strong aponeurosis from most important organs, such as the internal jugular vein, the spinal, pneumo-gastric, glosso-pharyngeal, and hypoglossal, nerves and from the internal carotid artery, although this is somewhat removed from the gland by the interposition of the styloid muscles. The occipital artery and its veins are also on the exterior of this space. It is sufficient to point out these relations, to show how important it is not to open this fibrous membrane.

The deep relations of the parotid gland with the lateral walls of the pharynx readily explain why certain tumours situated in the parotid space project both externally and towards the cavity of the pharynx. When this happens, the greatest difficulties and danger must necessarily attend the extirpation of the tumour.

Compression of the parotid gland has been employed for the purpose of producing its obliteration and atrophy, and for the cure of certain salivary fistulæ (Dessault). Notwithstanding the success obtained by Dessault, it is doubtful whether this proceeding is of much value. In fact, the parotid gland is too large, and too deeply placed in the cavity provided for its reception, to be influenced by compression.

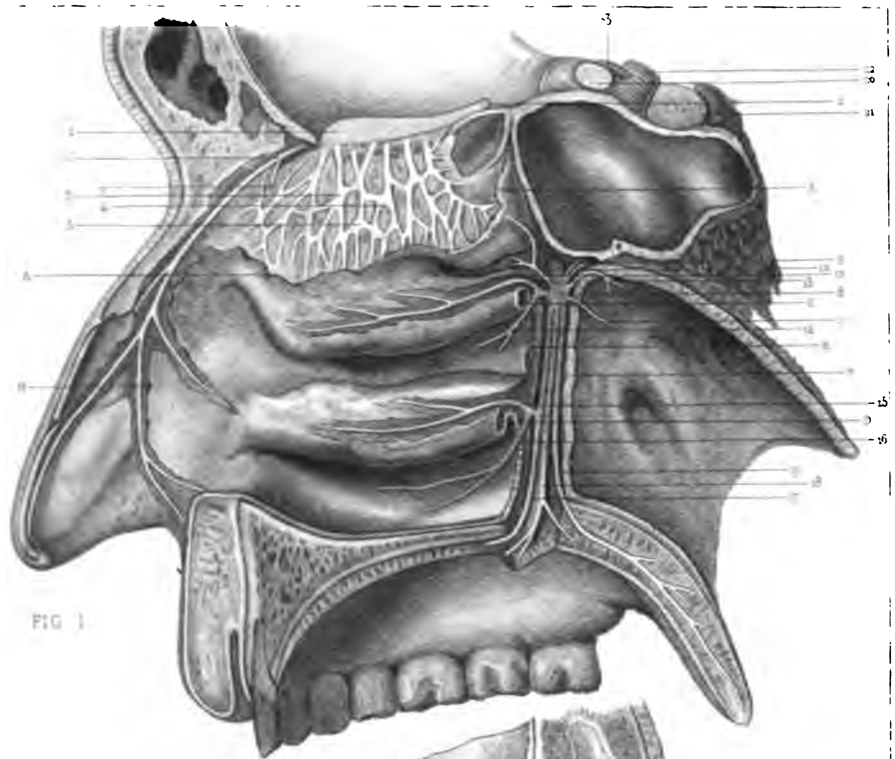
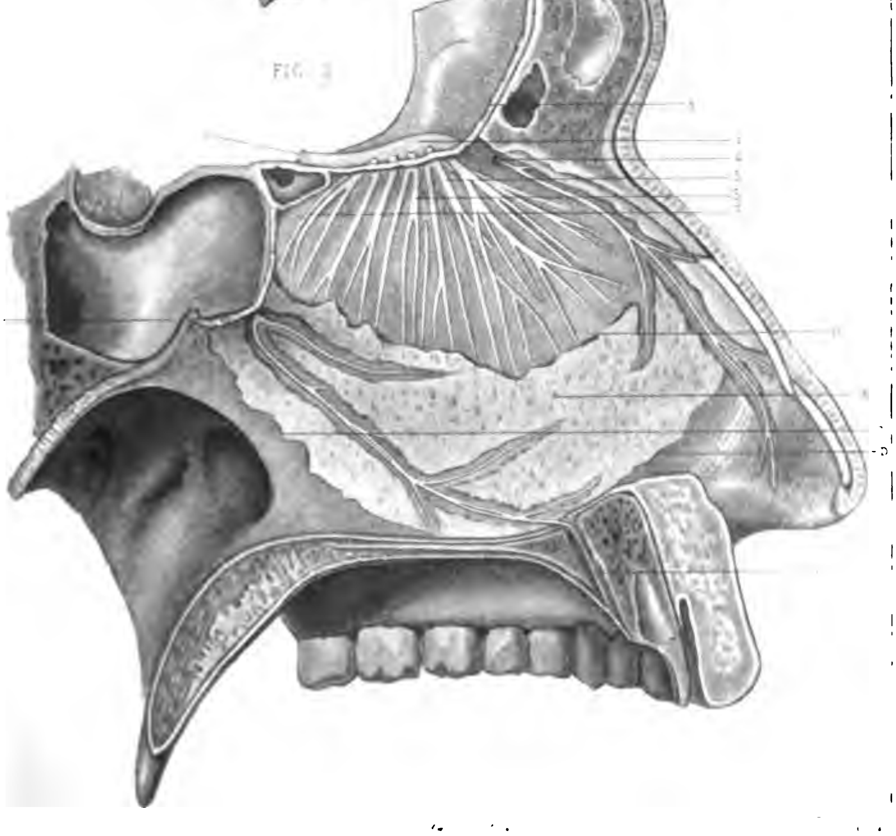


FIG. 1.

FIG. 2.



LIBRAIRIE GERMER BAILLIÈRE

PLATE XXIV.

Parotid Region.

The deep relations of the parotid

EXPLANATION.

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P. The stylo pharyngeus and stylo-glossus muscles covered by their aponeuroses.
Q. Aponeurosis covering the digastric muscle.
R. Section of the aponeurosis.
S. Lobules of the parotid gland.
T. Posterior surface of the posterior wall of th
pharynx.

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APPLICATIONS TO PATHO

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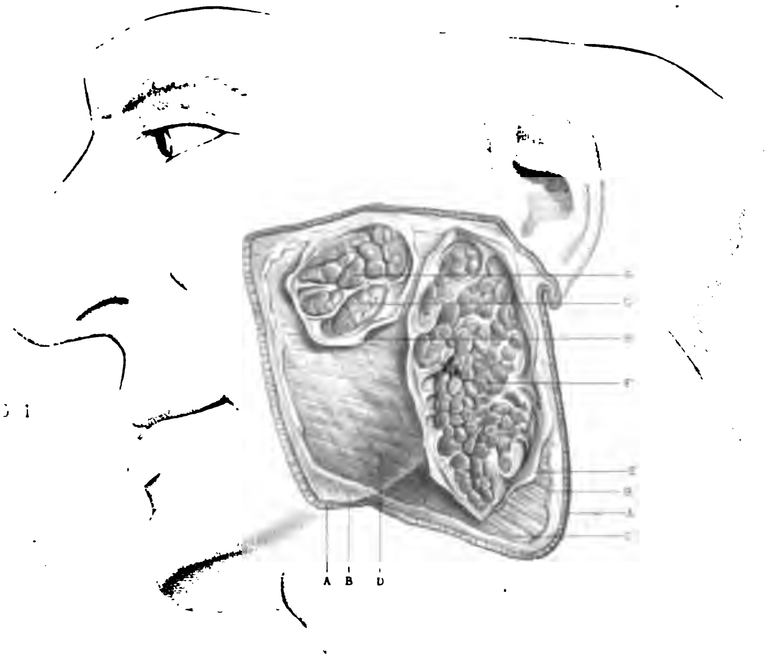

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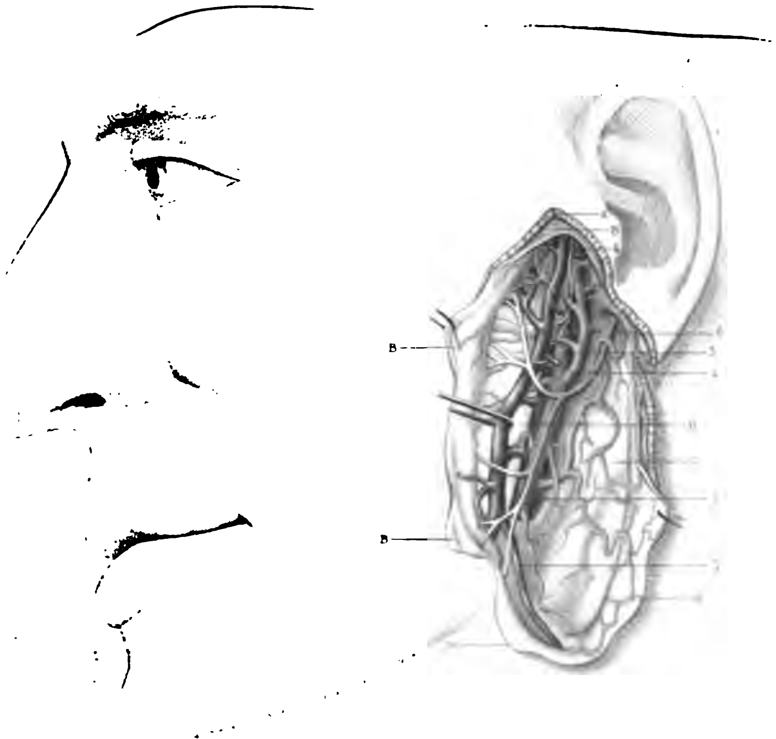

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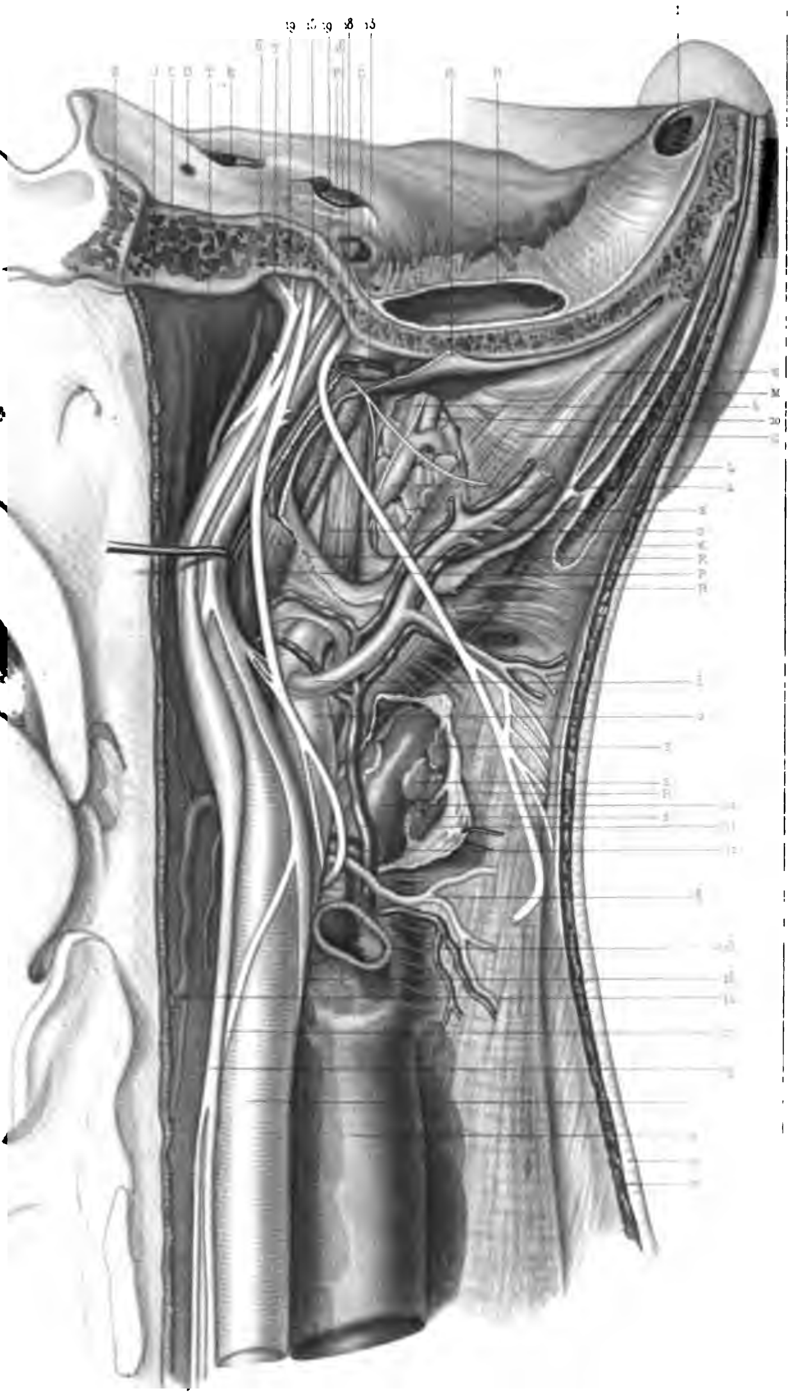

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PLATE XXV.

Figure 1.—**Region of the Masseter.**

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous cellular tissue.
C. Section of the parotid aponeurosis.
D. Parotid gland.
E. Accessory parotid gland (socia parotidis).
F. Steno's duct.
G. Masseter muscle, deep fibres.
H. Superficial fibres of the same muscle.
I. Platysma myoides muscle.

1. Superior transverse artery of the face.
2. Middle transverse artery of the face.
3. Inferior transverse artery of the face.
4. Ramification of the facial artery.

5, 6, 7. Superior transverse veins.
8. Inferior transverse veins.
9. Tempero-facial vein.
10, 11. Ramifications of the same vein.

12. Branch of the cervico-facial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

From the direction taken by Steno's duct it is more protected by the zygomatic arch, the nearer it approaches its buccal opening, and it is therefore more frequently wounded posteriorly than anteriorly. It is accompanied by a branch of the facial nerve, but this lies above it, and is therefore still more protected.

An important part has been attributed to the masseter muscle in the production of dislocation of the lower jaw. According to J. L. Petit and Pinel when the mouth is wide open, the angle formed by the axis of the condyle and the masseter is not more than one of four or five degrees; when this is the case the posterior fibres of the muscle being placed behind the condyle, their contraction draws the lower jaw in front of the eminentia articularis of the temporal bone and dislocation is produced. Boyer has disproved this explanation. If we divide the lower edge of the zygomatic arch from the tubercle, where the external lateral ligament of the tempero-maxillary articulation is inserted, to the malar suture, into five equal parts, four of these parts will correspond to the attachment of the masseter muscle. If we take the central point of this space and draw from it a horizontal line towards the throat, we shall find that this line falls exactly at the base of the pterygoid fossa, that is at the point where the internal pterygoid muscle is attached. But, in order that in forced depression of the lower jaw, the rami of the bone should cross the central line of the direction of the fibres of the internal pterygoid and masseter muscles, it is necessary that the condyles should be brought forwards so as to reach or even pass beyond the line of which we have spoken. So extensive a displacement never occurs, and supposes a degree of separation between the jaws that is never met with under similar circumstances. Displacement to half that extent cannot occur without dislocation, it is almost demonstrated that in dislocation of the lower jaw the masseter and pterygoid muscles are always in advance of the condyles and that the part they perform in the production of the dislocation does not differ materially from that of the pectoralis major, and latissimus dorsi muscles in dislocation of the humerus, unless it is by the obliquity of their action.

In regard to the articulation, if it is necessary to be thoroughly acquainted with the relations of the bones to each other, in order to determine the kind of displacement which characterises a dislocation. M. Malgaigne has shown that normally, in depression of the lower jaw the condyle is brought in front of the articular surface of the temporal bone, leaving a considerable portion of the fibres of the masseter behind it, which does not, however, prevent its return into the articular cavity. M. Malgaigne has proved that in true dislocation the condyles of the jaw are brought still more forward, and to admit of this there must be rupture of the capsule and of the external lateral ligature, or an abnormal laxity of the parts and possibly also rupture of some of the muscular fibres. Accepting this statement, M. Nélaton has subsequently shown that the reduction of the condyle is prevented and the dislocation maintained, because the apex of the coronoid process is wedged against the inferior angle of the malar bone, and becomes lodged in a small cavity which exists on the outer side of the malar tubercle.

The masseter muscle is occasionally subject to a kind of retraction which prevents the action of its fibres and so prevents the jaws from being opened. This condition may depend upon various causes, such as rheumatism, or syphilis. Several methods of treatment have been proposed; some are medical and are directed to the removal of the cause, others are surgical such as forcible separation of the jaws, or the subcutaneous division of one or both masseter muscles at the same time. We have met with one case which after resisting the action of the iodide of potassium, at the end of two years underwent a spontaneous cure.

Figure 2. — **Region of the side of the Chin.**

EXPLANATION.

A. Section of the skin and the subcutaneous layer.
B. Platyma myoides muscle.
C. Zygomaticus major muscle.
D. Zygomaticus minor muscle.
E. Buccinator muscle.
F. Fatty mass of Bichat.
G. Accessory parotid gland.
H. Steno's duct.

1. Facial artery.
2. Terminal ramification of the transverse facial artery.

3. Facial vein.
4. Vein accompanying the facial artery.

5, 6, 7. Lymphatic vessels.

8, 9. Branches of the facial nerve.

FIG. 1

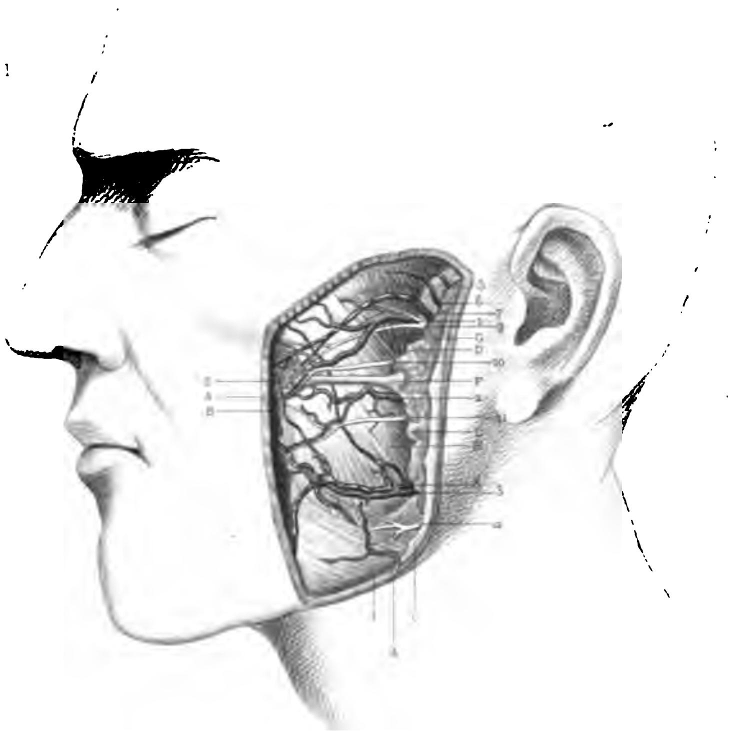
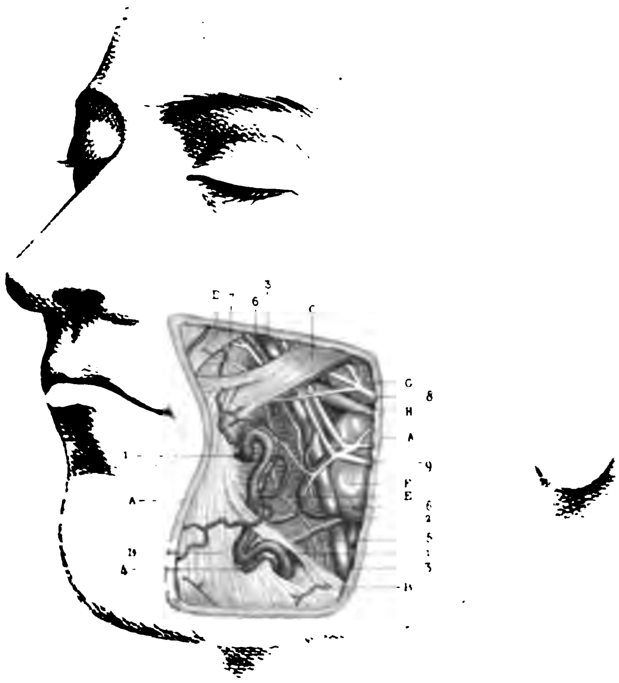


FIG. 2



LIBRAIRIE GERMER BAILLIÈRE

To correct this malformation, the edges of the divided parts must be paired, and then brought together by suture; but when union has taken place there is almost invariably a small depression on the free margin of the lip. MM. Malgaigne and Clémot (of Rochefort) have devised a proceeding which consists in dissecting off two small flaps which instead of being separated are reversed so as to fill up the space seen in the lip in the situation of the cicatrix. M. Mirault makes only a single flap which he takes from the portion of the lip supporting the median tubercle, he then pares the opposite portion of the lip and brings them together. This flap is placed horizontally along the free margin of the lip and fills up the depression which usually forms. M. Nélaton has proposed a happy modification of these plans. Instead of forming two flaps, he carries his incisions beyond the angle formed by the division of the lip, where they unite so that the detached portions of the lip represent the letter V inverted; this flap being reversed forms below the division the same letter V, but in its right position. This flap thus constitutes a kind of natural suture.

With regard to the vertical perforation of the lower lip which we have described after M. Demarquay, it has since been observed by M. Richet, M. Depaul, and Mr. Murray of Brighton.*

The enlargement of the lower lip may be either congenital or accidental. When it is congenital it may form a kind of mucous cushion, more or less mishapen, which in some cases it is necessary to remove; sometimes this malformation is due to hypertrophy of the mucous glands. We have seen one case under the care of M. Nélaton which was cured by excision.

Extremely vascular and often irritated by coming in contact with external substances of various degrees of temperature the lips are very subject to morbid changes, amongst which must be enumerated cancer and its several varieties. Erectile tumours are not uncommon. We saw one case in conjunction with M. Robert to which this surgeon had applied the actual cautery. The lips are often the seat of operations for the cure of cancer. As they are moveable, flexible and covered with a double integument, they present facilities for their restoration by operation which here receives the name of *chiloplasty*. When the loss of substance is small, after removing the tumour by a curved incision, the lost portion may be repaired from the mucous membrane, which is used to form the margin of the lip; this proceeding which M. Richet terms *bordering* (*bordage*) was employed with great success in a case of cancroid growth of the lip. The continuity of the lower lip with the neighbouring parts and also with the sub-hyoid region explains why by the French method we can repair large losses of substance. It is upon this disposition of the parts that the proceedings of M. Chopart, of M. Roux, of Saint Maximin, of Lesfranc and Morgan, of M. Serre, and of M. Malgaigne are based.

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* The malformation described by Mr. Murray was caused by the presence of two sacculi in the lower lip, and occurred in four members of the same family, consisting of the parents and eight children. The malformation was present in the father, in two girls, and in one boy. A description of the case was published in the British and Foreign Medico-Chirurgical Review for October, 1860.—TRANS.

PLATE XXVI.

FIGURE 1. — Region of the Lip.

Superficial Layer.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous layer.
C. Superficial fibres of the orbicular muscle of the lower lip.
D. Superficial fibres of the orbicular muscle of the upper lip.
E. Muscular fibres of the orbicular muscle passing towards the septum of the nose.
F. Interlacing of the muscular fibres of the zygomaticus major, with the orbicular muscle near the angle of the lip.
G. The zygomaticus major muscle in the labial region.
H. The superior fibres of the depressor anguli oris interlacing with the fibres of the orbicular muscle.
I. Elevator of the upper lip and the ala of the nose.
J. Triangular muscle of the chin (depressor anguli oris).
K. Fibres of the zygomaticus minor muscle interlacing with the fibres of the orbicular muscle.

1. Facial artery.
2. Superficial labial artery of the lower lip, a branch of the facial artery.
3. Superficial labial artery of the upper lip, a branch of the facial artery.

4. Superficial veins of the upper lip going to join the facial vein.
5, 6. Superficial veins of the lower lip emptying themselves into the facial vein.

7. Superficial branch from the mental nerve (5th pair).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The muscles and vessels of the lips account for certain peculiarities belonging to wounds of the lips. Thus when the muscles are involved, the union will be incomplete unless we guard against the tendency of the muscles to separate the edges of the wound, it is for this reason, that when the wound extends beyond the skin, and especially where it involves the entire thickness of the organ, that union can only be insured by the use of the suture. The great number of arteries and veins explains the amount of hæmorrhage which accompanies the majority of these wounds, and which is generally arrested by applying a suture to the edges of the wound. The flexibility of the lips and their double surface enables us to exercise sufficient compression with the fingers to prevent or arrest the hæmorrhage in the operation for hare-lip.

FIGURE 2. — Region of the Lip.

Deep Layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the superficial muscles.
D. Subcutaneous fatty tissue.
E. Muscular fibres of the orbicular of the upper lip.
F. Deep fibres of the levator labii superioris alæque nasi and of the levator labii superioris.
G, H. Small glands in the muscular fibres of the upper lip.
I, J, K. Labial glands of the lower lip.
L. External surface of the mucous membrane of the lip.

1. Inferior coronary artery (terminal branch of the facial.)
2. Coronary artery of the upper lip (terminal branch of the facial).
3. Branch anastomising with the facial (irregular).

4. Coronary vein of the lower lip.
5. Ramifications of the coronary vein.
6. Coronary vein of the upper lip.

7, 8, 9, 10, 11. Terminal filaments of the infra-orbital nerve distributed to the skin and mucous membrane of the upper lip (5th pair).
12, 13, 14. Terminal filaments of the mental nerve distributed to the mucous membrane of the lower lip (5th pair).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The small glands situated in the deep layer of this region may become hypertrophied and thus give rise to tumours that can be easily enucleated. These tumours form projections towards the side of the mucous membrane in consequence of the glands being placed nearer to this membrane than to the skin. It must not, however, be forgotten that these hypertrophied tumours may make their appearance towards the side of the skin. We witnessed a very remarkable case of this kind under the care of M. Michon, and this may be accounted for by the presence of a number of extremely minute glands which occasionally occupy the interstices of the muscles extending even to beneath the skin, as we have proved by dissection.

There are few organs more predisposed to malformations than the lips. These malformations consist of an imperforate condition of the buccal orifice, narrowing of the opening, hare lip, swelling, enlargement of the lips, and a vertical perforation of the lower lip.

To cure the imporate condition, an incision must be made along the groove which marks the opening of the mouth, the lips covered with lint coated with cerate and then kept apart and everted so as to prevent their reunion. The same proceeding must be adopted in the case of contraction of the buccal orifice.

Hare lip is generally congenital and situated in the upper lip; it may be single or double, simple or complicated.

PLATE XXVII.

Figure 1. — **Region of the Chin.**

EXPLANATION.

RIGHT SIDE (*superficial layer*).

A. Section of the skin bounding the region.
B. Section of the fatty subcutaneous fascia.
C. Depressor anguli oris.
D. Depressor labii inferioris.
E. Section of the muscular fibres of the levator labii inferioris.

1. Artery furnished by the submental traversing the fibres of the depressor anguli oris and going to the skin of the region.

LEFT SIDE (*deep layer*).

A. Section of the skin bounding the region.
B. Section of the depressor anguli oris.
C. Section of the depressor labii inferioris.
E. Section of the levator labii inferioris.
F. Periosteum covering the lower jaw.

1. Mental artery, a branch of the sub-mental, anastamosing with the coronary artery of the lip.

2. Branches of the facial nerve going to form the mental plexus.
3. Mental nerve, anastamosing with the preceding and distributed to the mucous membrane and skin of the lower lip (branch of the 5th pair.)

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This region projects and is exposed to various contusions and wounds. Its skin is thick and covered with hairs whose follicles are subject to an inflammation accompanied by scaly pustules, characteristic of the disease termed *mentagra* or *sycosis.* Its tissues being continuous with those of the labial region, it participates in their diseases and often furnishes the materials of reparation in cases of chiloplasty. Wounds of the chin, like those of the eyebrow are often more serious than they appear, because the deep tissues are more injured than the superficial.

Fracture of the symphysis, which was at one time denied, has now been clearly established. As the projection of the chin exposes it to injuries, it follows that the effects of a blow on this region are transmitted to the maxillary bone, by which it may be fractured, or if the force is oblique it is transmitted to the articulation and produces a dislocation. M. Velpeau has pointed out the presence of a subcutaneous serous bursa opposite the chin and M. Richet has met with an abscess in this cavity.

Figure 2. — **Buccal Region.**

EXPLANATION.

A. Section of the skin.
B. Section of the fatty subcutaneous fascia.
C. Section of the lower jaw.
D. Projection formed by the superior maxillary bone.
E. Root of the central incisor tooth.
F. Section of the masseter muscle.
G. Section of the internal pterygoid muscle.
H. The stylo-glossus muscle traversed by the inferior or ascending palatine artery.
I. Stylo-hyoid muscle covered by its aponeurosis.
J. Insertion of the digastric muscle into the lower jaw.
K. Section of the mylo-hyoid muscle.
L. Section of the genio-hyoid muscle.
M. Section of the platysma myoides muscle.
N. Section of the levator labii inferioris muscle.
O. Section of the muscular fibres of the lower lip.
P. Section of the muscular fibres of the upper lip.
Q. Section of the muscular fibres of the elevator muscles of the upper lip.
R. Section of the zygomaticus major muscle.
S. Section of the buccinator muscle.
T. Section of the buccal mucous membrane.
U. Section of the lingual mucous membrane.
V. Section of the labio-gingival mucous membrane.
X. Section of the fold of the mucous membrane forming the frænum of the tongue.
a. The parotid gland.
b. Section of Steno's duct.
c. Section of the cavity for the parotid gland.
e. Sub-maxillary gland.
f. Wharton's duct.
g. Sublingual gland.
h, i. Labial glands.

1. Facial artery.
1′. Section of the facial trunk of this artery.
2. Artery going to the sub-maxillary gland and to the internal pterygoid muscle.
3. Submental artery.
4. Ranine artery.
5. Inferior labial artery.
6. Superior labial artery.
7. Artery going to the masseter and internal pterygoid muscles.
8. Inferior dental artery.

9. External jugular vein.
10. Submental vein.
11. Ranine vein.
12. Labial artery.
13. Facial veins.

14. Lympathic glands.
15. Lingual nerve.
16. Inferior dental nerve.
17. Cervical branch of the facial nerve.
18. Section of the glosso-pharyngeal nerve.
19. Section of the hypo-glossal nerve.
20. Sub-maxillary ganglion.
21. Sublingual ganglion.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

A tumour occurs beneath the tongue, termed *ranula,* of which the seat has been placed at different times in Wharton's duct, in the lobules of the glands, in the mucous sac of Fleischmann and in the sub-mucous cellular tissue. We consider that the cases which have been recorded are sufficiently numerous to prevent our holding any one of these opinions exclusively, and that in fact all these organs may give rise to ranula. Dupuytren and Breschet have seen this tumour formed by a serous, or muco-serous cyst developed beneath the mucous membrane.

M. Malgaigne, relying on the microscopical examinations of M. Ch. Robin, admits that the lobules of the glands may be the seat of this formation, and M. Jobert of Lamballe as well as M. Richet have seen Wharton's duct open into the cavity itself, indicating a dilitation of this canal. The situation and size of the tumour readily explain the phenomena which accompany it. Being restricted by the lower jaw in front and by the upper jaw above, it pushes the tongue backwards and the floor of the mouth downwards. Such a tumour has been seen entirely filling the mouth (F. de Hilden), compressing the carotids and the trachea (Marchetti), producing suffocation (Alix), or preventing mastication (Taillardant). This disease is very liable to return, as we may judge from the variety of proceedings which have been proposed; 1st. Incision; 2nd. Opening either with a bistouri or by the actual cautery; 3rd. The introduction

FIG. 2.

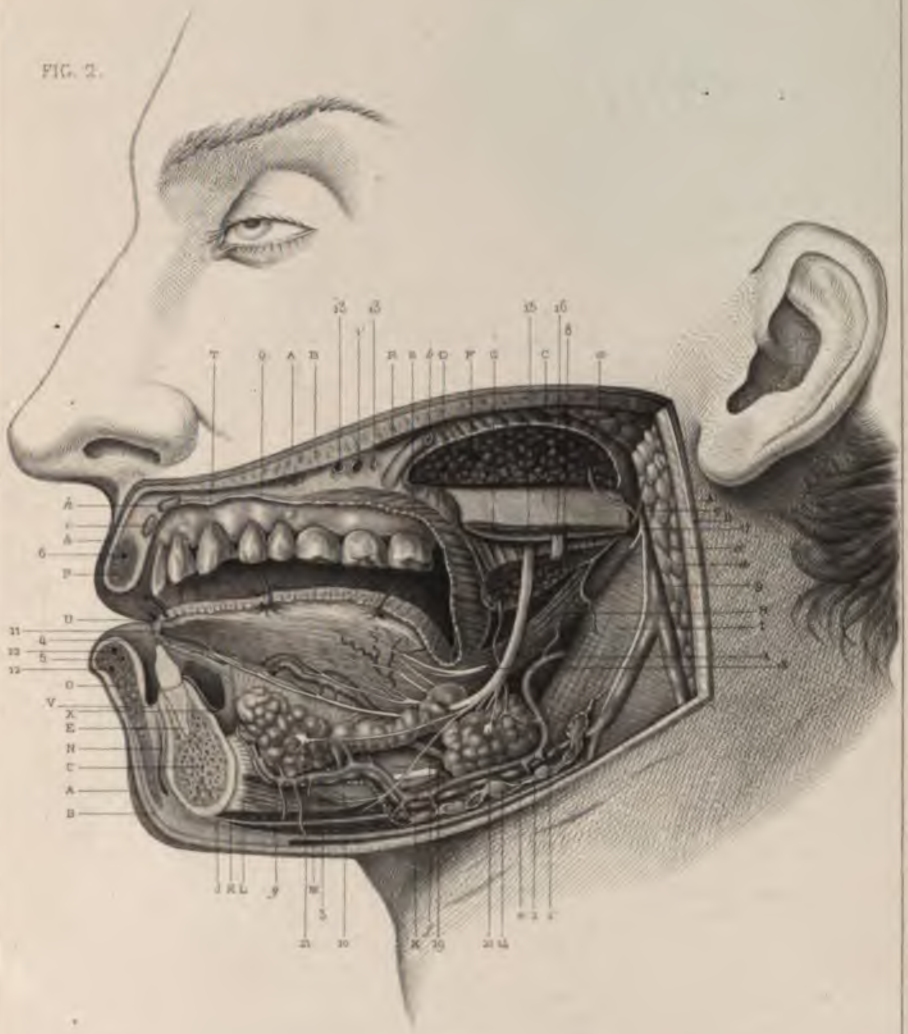
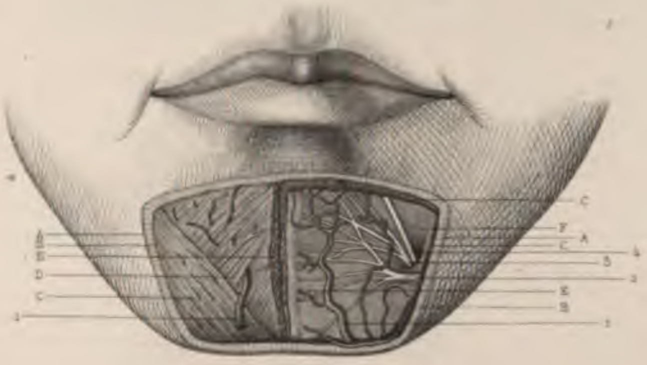


FIG. 1.



F. Bion del.   Imp. F. Chardon aîné, Paris   Sélon sc.

LIBRAIRIE GERMER BAILLIÈRE.

N. Interspinalis muscle.
O. Intermuscular aponeurosis.
P. Fold of this aponeurosis inserted into the occipital bone.
Q. Fatty cellular tissue contained in the fold of this aponeurosis.
R. Cavity of the dura mater of the spinal cord.
S. Section of this membrane.
1. Hypoglossal nerve.
2. First cervical nerve passing between the atlas and the occipital bone.
3. Second cervical or sub-occipital nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This figure is intended to show the region of the tonsil, but it also exhibits the exact relations of all the organs of the neck and face, so that many applications may be made from it to operative surgery.

Abscesses in the region of the tonsil may be situated: 1. Beneath the mucous membrane: 2. In the small glands; 3. In the subcutaneous cellular tissue of the tonsil. The latter generally forms a projection a little below the angle of the jaw, where we meet with the skin, the platysma, myoides, a fibrous layer covering this muscle, and a venous plexus formed by the facial, lingual, pharyngeal, laryngeal, superior thyroid and occipital veins, and a branch of communication between the internal and external jugular veins. Although it is desirable to act promptly for the purpose of opening these abscesses, and prevent their spreading along the course of the carotid arteries, it is still necessary to wait until they present beneath the skin, otherwise the knife would have to traverse the whole of this vascular plexus.

The tonsils are frequently subject to a chronic enlargement of an inflammatory, or hypertrophied character, which produces considerable impediment to deglutition, respiration, and phonation, and requires their removal. This operation is easily performed by a modification of Fahnestock's instrument, or by means of a bistouri and a hook. Ordinarily this operation is not followed by any ill result, but sometimes severe hæmorrhage ensues, which is to be restrained, either by direct compression, the use of ice, or the application of the perchloride of iron, and when these means fail, by compression of the carotids. In one case the latter plan succeeded with us when all the others had failed. Formerly fears were entertained of wounding the internal carotid in removing the tonsil; an examination of the Figures 1 and 2 in Plate XXIX is sufficient to convince us that this danger is imaginary. When hæmorrhage does occur it comes from the venous plexus beneath the tonsil, or from a small branch furnished by the ascending pharyngeal artery.

The position of the tonsil in relation to the opening of the Eustachian tube in the pharynx is too distant for us to admit, with Dupuytren, that even in the child the swelling of the tonsil can occur to such an extent as to close up the opening and produce deafness.

The tonsil may be the seat of cancer, or of cysts, whose removal is not always possible, on account of the depth at which the organ is placed.

It is not uncommon to meet with whitish concretions on the surface of the tonsils that at first give one the idea of a false membrane, but which are merely the production of the follicles of the tonsil. There may, however, exist true calcareous concretions; an accurate account of these formations is contained in the Mémoires de l'Académie de Chirurgie.

The uvula is generally placed in the median line, sometimes it naturally deviates slightly either to the right or to the left, it is situated immediately above the epiglottis which it may constantly irritate when elongated from acute or chronic infiltration. This irritation is accompanied by such continual coughing that it is necessary to excise the uvula. This operation is performed in the following manner. The patient is seated opposite the light, with the mouth widely opened, the tongue is depressed and the extremity of the uvula seized with a pair of dissecting forceps, or what is better with a pair of hooked forceps. It is then easily drawn forwards and excised by a single cut with a pair of curved blunt-pointed scissors; if, hæmorrhage should follow the excision, which, however is rare, it is sufficient to seize the end of the uvula with a pair of torsion forceps and compress it for some time.

The relations of the isthmus of the fauces to the air passages and to the alimentary canal are here clearly shown, and illustrate the physical and mechanical conditions which preside over the passage of the air and of the food into the pharynx. If we examine the anterior surface of the vertebral column on a level with the nasal fossæ and again on a level with the isthmus of the fauces we shall notice this important fact that there is a curve and a concavity. The curve is superior or nasal, it is formed by the anterior arch of the atlas and is so arranged that if a tengential line is drawn from its most prominent part, the lower end of this line will pass to the centre of the air passages. It follows that air passing through the nasal fossæ is naturally conducted forwards into the base of the pharynx, and thus directly enters the larynx. Any foreign body falling from the nasal fossæ into the pharynx will be projected into the larynx in consequence of the presence of this curve.

At the bottom of the curve is a concavity which exactly corresponds to the isthmus of the fauces, and forms the pharyngeal funnel or infundibulum of the æsophagus. It follows therefore that the food passes rapidly from the isthmus of the fauces into this part of the pharynx which is on a level with the third and fourth cervical vertebræ. It is by means of this simple arrangement of the curve that nature performs these complicated actions.

PLATE XXVIII.

FIGURE 1. — **Pterygo-maxillary Region.**

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the malar bone.
D. Section of the zygomatic arch.
E. Section of the horizontal portion of the lower jaw.
F. Section of the ascending ramus of the lower jaw.
G. Capsule of the tempero-maxillary articulation.
H. Tuberosity of the superior maxillary bone.
I. Pterygoid process.
J. Spine of the sphenoid bone.
K. Section of the temporal muscle.
L. Section of the masseter muscle.
M. Section of the external pterygoid muscle.
N. Fibres of this muscle passing to be inserted into the spine of the sphenoid bone.
O. Internal pterygoid muscle.
P. Buccinator muscle.
Q. Section of the parotid gland.
R. Section of the cavity for the reception of the parotid gland.

1. Internal maxillary artery.
2. Middle meningeal artery.
3. Small meningeal artery.
4. Deep middle temporal artery.
5. Anterior deep temporal artery.
6. Spheno-palatine artery.
7. Infra-orbital artery.
8. Mylo-hyoid artery.
9. Buccal artery.
10. Superior and posterior alveolar artery.
11. Anterior maxillary vein accompanying the artery of the same name.
12. Section of the preceding vein.

13. Inferior maxillary nerve.
14. Lingual nerve.
15. Inferior dental nerve accompanied by its vein and artery which is covered by it.
16. Chorda tympani nerve.
17. Nerve distributed to the mylo-hyoid muscle.
18. Buccal nerve.
19. External pterygoid nerve.
20. Posterior deep temporal nerve.
21. Middle deep temporal nerve.
22. Anterior deep temporal nerve.
23. Superior maxillary nerve.
24. Posterior and superior dental nerves.
25. Spheno-palatine ganglion.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This region is, so to speak, the common rendez-vous of all the tumours of the neighbouring parts. Thus fungoid tumours of the dura mater emerging through the various foramina at the base of the cranium, tumours of the orbit through the spheno-maxillary fissure, tumours of the maxillary sinus through the tuberosity of the maxillary bone, which is exceedingly thin, naso-pharyngeal polypi, and polypi of the upper part of the pharynx, through the lateral walls of the pharynx, and through the sphenoidal and spheno-maxillary fissures often by their prolongations enter this region, and may then penetrate into the temporal fossa, where they are recognised by the surgeon. He must, therefore, be on his guard not to consider the tumour as belonging to the temporal region, and so undertake its removal.

It is sufficient to know the number of arteries and veins belonging to this region to understand the difficulties the surgeon must encounter in arresting the hæmorrhage which occurs in removing a tumour in this situation. The internal maxillary artery, traverses the region in an oblique direction, placed at a considerable depth, protected from wounds by the masseter and internal pterygoid muscles, as well as by the ascending ramus of the lower jaw. It is in consequence of its being thus situated that it cannot be tied.

The inferior ductal nerve is sometimes the subject of neuralgia requiring its division; this operation may be performed before it enters the canal (Varren), or in the canal (Velpeau), or as it emerges from the mental foramen. It may also be performed through the buccal mucous membrane (Malgaigne). A straight blunt pointed bistouri is introduced between the bone and the internal pterygoid muscle, a little above the orifice of the dental canal, and the nerve is divided by making a kind of sawing movement with the point of the instrument against the bone.

FIGURE 2. — **Region of the Isthmus of the Throat.**

Antero-posterior section of the face and neck.

EXPLANATION.

Anterior portion.

A. Section of the skin.
B. Section of the superficial fascia.
C. Section of the frontal bone.
C′. Frontal sinus.
D. Section of the superior maxillary bone.
D′. Anterior palatine canal.
E. Section of the inferior maxillary bone.
F. Section of the hyoid bone.
G. Section of the lateral cartilage of the nose.
H. Section of the cartilage of the ala of the nose.
I. Section of the thyroid cartilage.
J. Section of the cricoid cartilage.
J′. Section of the cricoid cartilage at its anterior part.
K. Section of the first cartilaginous ring of the trachea.
L. Section of the platysma myoides muscle.
M. Section of the sterno-hyoid muscle.
N. Section of the right genio-glossus muscle.
N′. Fatty tissue between the genio glossi muscles.
O. Tendon of the right genio-glossus muscle.
P. Right genio-hyoid muscle.
Q. Section of the mylo-hyoid muscle.
R. Section of the subcutaneous fatty tissue.
S. Thyro-hyoid membrane.
T. Crico-thyroid membrane.
a. Septum of the nose.
b. Sphenoidal sinus.
b′. Opening of the sphenoidal sinus in the posterior part of the nasal fossæ.
c. Eustachian tube opening on the lateral wall of the pharynx.
d. Antero-posterior section of the tongue a little to one side of the median line.
e. The gland of Nuhn.
f. Section of the velum palati and the glandular layer of the velum.
g. The uvula,
h. The tonsil.
i. Posterior pillar of the velum.
j. Section of the epiglottis.
k. Section of the mucous membrane of the superior part of the larynx behind the epiglottis.
l. Serous bursa situated behind the body of the hyoid bone.
m. The arytenoid muscle and section of the posterior wall of the larynx.
n. Ventricle of the larynx.
o. Superior vocal cord.
p. Inferior vocal cord.
q. The trachea.
r. Section of the mucous membrane of the posterior wall of the trachea.
s. Section of the fibrous membrane of the trachea.
t. Section of the œsophagus.
u. Parietes of the œsophagus.

The posterior part of the neck including the vertebral column.

A, B. Section of the skin at the posterior part of the neck.
C. Section of the occipital bone.
D. Section of the anterior arch of the atlas.
D′. Section of the posterior arch of the atlas.
E. Section of the body of the axis.
F. Section of the body of the first dorsal vertebræ.
F′. Section of the spinous process of the seventh cervical vertebra.
F″. Section of the intervertebral substance.
G. Section of the subcutaneous and fat fascia.
H. Section of the trapezius muscle at its fibrous portion.
I. Section of the splenius muscle of the neck.
J. Section of the complexus muscle.
J′. Superior fibres of the complexus muscle.
K. Rectus capitis posticus minor muscle.
L. Section of the rectus capitis posticus major muscle.
M. The mutifidus spinæ muscle.

FIG. 1.

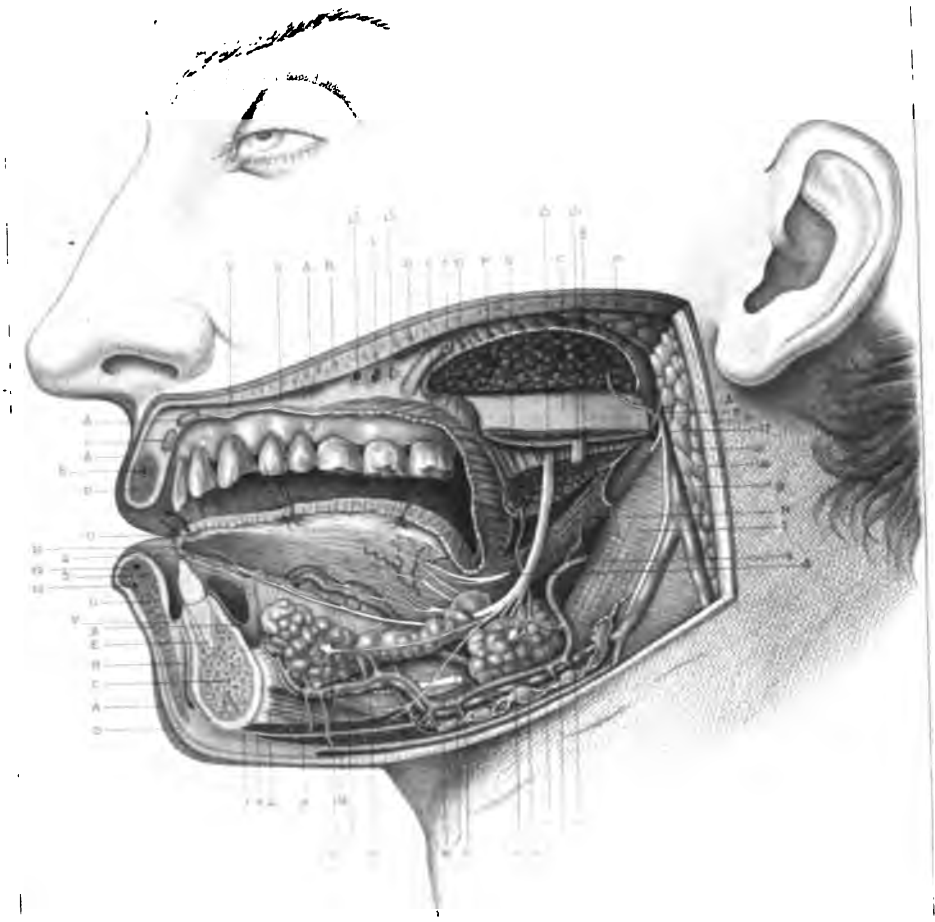


FIG. 2.

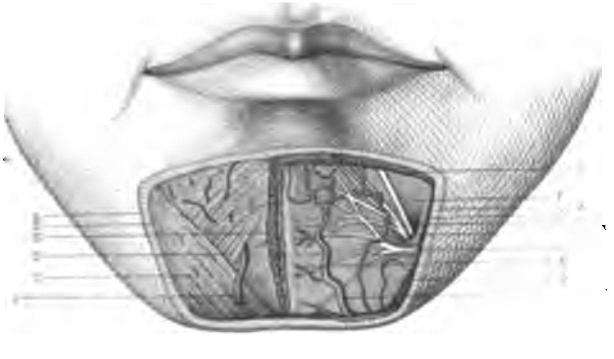


PLATE XXIX.

FIGURE 1. — Buccal Region.

Superior wall of the mouth and the inferior surface of the velum palati.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Section of the spinous process of the axis.
D. Section of the ascending ramus of the lower jaw.
E. Section of the trapezius muscle.
F. Section of the sterno-cleido-mastoideus muscle.
G. Section of the splenius capitis muscle.
H. Section of the complexus muscle.
I. Section of the biventer cervicis muscle.
J. Section of the rectus capitis posticus major muscle.
K. Superior tendinous portion of the levator anguli scapulæ and of the scaleni muscles.
L. Section of the digastric muscle.
M. Section of the internal fascia of the longus colli muscle.
N. Section of the external fascia of the same muscle.
O. Section of the rectus capitis anticus major muscle.
P. Section of the stylo-hyoideus muscle.
Q. Section of the stylo-pharyngeus muscle.
R. Section of the stylo-glossus muscle.
S. Section of the internal pterygoid muscle.
T. Section of the masseter muscle.
U. The palatine fibres of the tensor palati.
V. The divided fibres of the orbicular muscle of the lips.
X. Section of the parotid gland.
Z. Fatty mass of Bichat.

1. Posterior or descending palatine artery.
2. Terminal branch of the ascending pharyngeal artery.
3. Section of the spinal cord.
4. Cavity of the arachnoid membrane of the spinal cord.
5. Section of the dura mater of the spinal cord.
6. Sub-occipital nerve.
7. Posterior palatine nerve.
8. Section of the palatine nerve terminating in the velum.
9. Section of the lingual nerve.

LEFT SIDE.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Section of the spinous process of the axis.
D. Section of the ascending ramus of the lower jaw.
E. Section of the trapezius muscle.
F. Section of the sterno-cleido-mastoideus muscle.
G. Section of the splenius muscle.
H. Section of the complexus muscle.
I. Section of the biventer cervicis muscle.
J. Section of the rectus capitis posticus major.
K. Section of the scaleni muscles.
L. Section of the digastric muscle.

N. Section of the lateral wall of the pharynx.
N′. Section of the pillars of the velum.
O. Section of the bucco-pharyngeal aponeurosis.
P. Section of the tonsil.
Q. Section of the orbicular muscle of the lips.
R. Glandular layer of the palatine arch and of the velum.
S. Section of the parotid gland.
T. Fatty mass of Bichat.

1. Section of the internal carotid artery.
2. Section of the temporal artery.
3. Section of the occipital artery.
4. Section of the ascending pharyngeal artery.
5. Section of the inferior dental artery.
6. Section of the buccal artery.
7. The facial artery and its branches.

8. Internal jugular vein.
9. Intermediate vein uniting the internal and external jugulars.
10. Inferior dental vein.
11. Vertebral vein accompanied by the artery of the same name.
12. Anterior venous sinus of the spinal cord.

13. Lingual nerve.
14. Inferior dental nerve.
15. Facial nerve.
16. Glosso-pharyngeal, pneumogastric, spinal and hypoglossal nerves.
17. Sub-occipital nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The roof of the palate is sometimes divided more or less completely antero-posteriorly, the malformation accompanying and complicating the condition of hare lip. This congenital division does not occur directly in the median line as has been supposed, but somewhat to one side of it as is proved by the researches of M. Legendre and by our own.

The mucous membrane is here thick and strong and beneath it is seen a layer of small glands which secrete the saliva, and which may become hypertrophied either separately or in groups, and constitute a kind of tumour that was formerly regarded as cancerous, but which, according to the researches of MM. Michon and Nélaton is nothing more than a simple hypertrophy presenting this peculiar character that it may be easily enucleated. In order to remove it, it is sufficient to make a simple or crucial incision over the most prominent part, and then extract it either with the spatula or the end of the finger.

In this glandular layer we meet with a large number of vessels which furnish a considerable quantity of blood in operations on the palatine arch.

The periosteal layer is very thick and strongly adherent, but when carefully separated it may be used to fill up fissures in the arch of the palate by a plastic operation on the periosteum, a method employed for the first time by Mr. Jordan of Manchester for the cure of false joints.

The soft palate is sometimes divided and this may be either congenital or the result of disease; this division may be cured by cauterisation (Cloquet) or better by means of staphyleraphy. This operation, introduced by Roux, has been modified with regard to the passing of the threads (Béraud), as regards the paring of the edges, and as regards the number of the sutures. Frequently after this operation the edges do not come together sufficiently, or are too much on the stretch; it has been proposed to overcome this by making lateral incisions (Duffenbach) or by dividing the posterior pillar of the velum (Warren), or by making these lateral incisions and this division simultaneously (Fergusson); we ought not, however, to have recourse to these incisions unless they are absolutely necessary, and it is wrong to make them before seeing the result.

As after this union the uvula ceases to exist, and the velum presents the same kind of indentation as the lip after the operation for hare-lip, M. Nélaton has applied here the same kind of proceeding that he adopted to prevent the depression in the lip.

The arch of the palate may be the seat of perforations arising from wounds, syphilis, or scrofula, these are to be treated either by the method of Roux, Warren or Malgaigne. Latterly, M. Baizeau has successfully employed the following plan: he first pairs the edges of the fissure, and in order to straighten the edges, which present too considerable a curve to allow of their coming together easily, he prolongs his incisions anteriorly and posteriorly to the extent of five millemetres (0·196 English inch), beyond the perforation which is thus increased in length one centimetre (0·3937 English inch) in the direction of the long axis of the palate. He then makes on each side parallel to the dental arch, an incision which extends six millemetres (0·2362 English inch) beyond the fissure anteriorly and posteriorly. He then detaches by angular knives and a spatula similarly bent, the anterior portion of the soft parts attached to the bony palate, the flaps thus set free come together of themselves; very thin anteriorly, they become thicker at the posterior part, in consequence of the junction of the nasal mucous membrane with the buccal mucous membrane. M. Gosselin also succeeded in a case by this method (*Bulletin de la Société de Chirurgie,* 1862, p. 459).

FIG 1

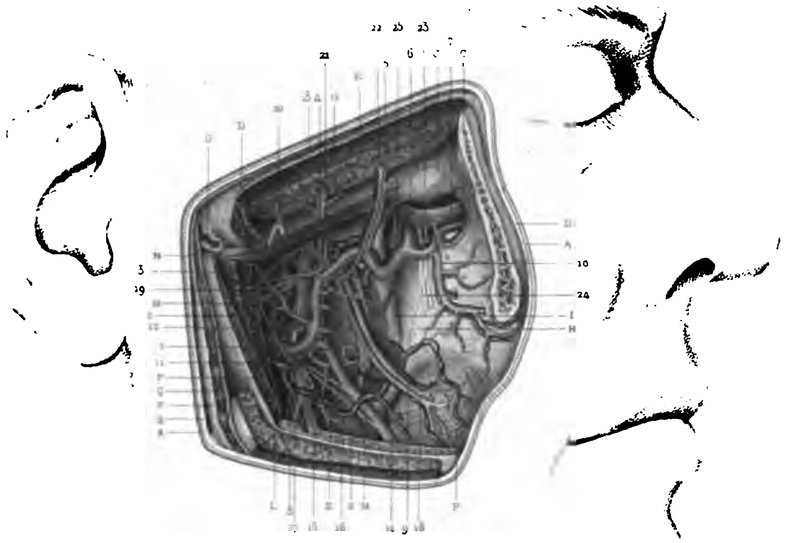
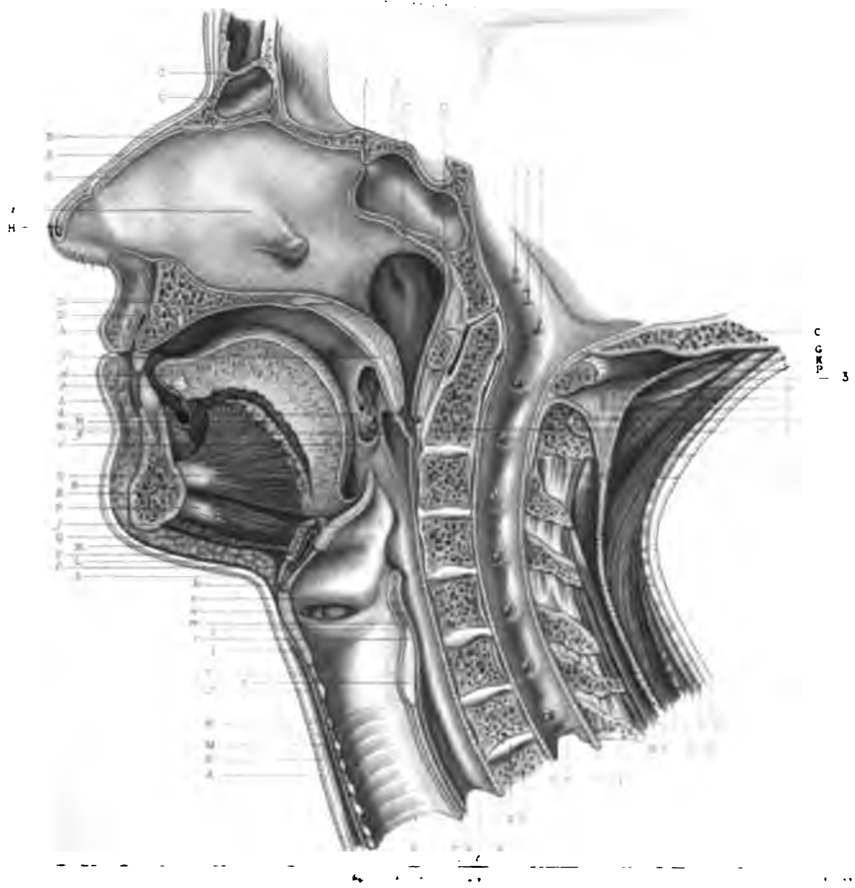


FIG 2



LIBRAIRIE GERMER BAILLIÈRE

FIG. 1

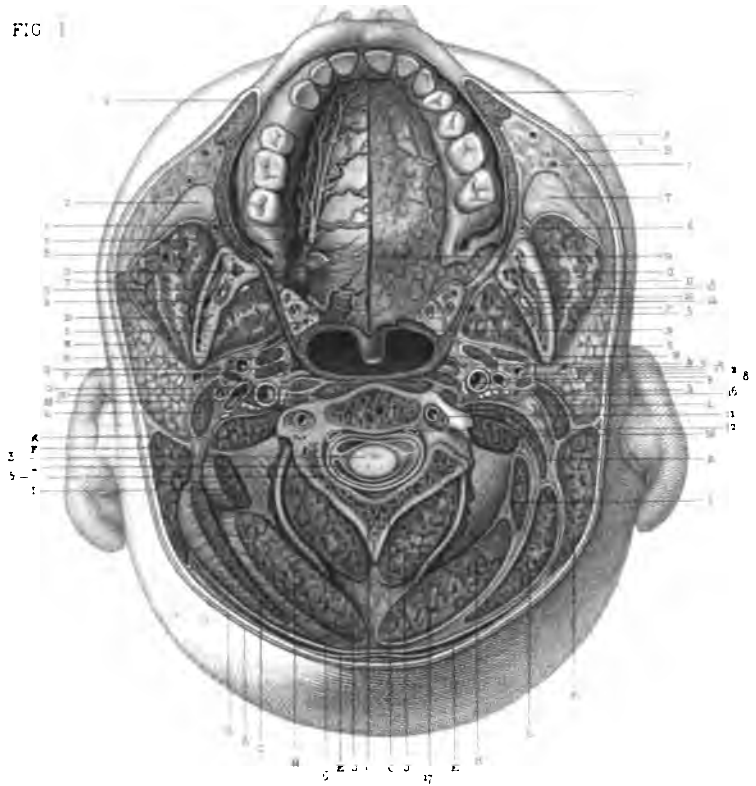


FIG. 2

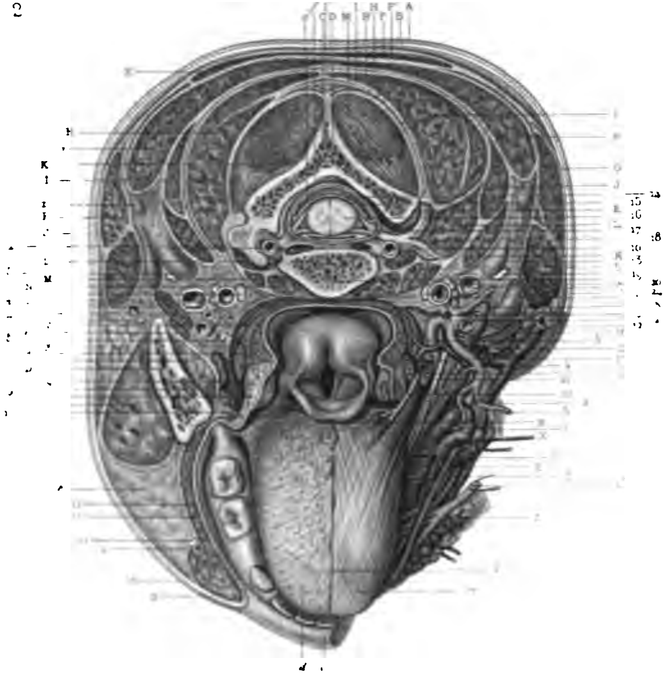


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PLATE XXX.

Region of the Pharynx.

EXPLANATION.

LEFT SIDE.

A. Section of the skin.
B. Subcutaneous layer.
C. Section of the periosteum.
D. Section of the temporal bone.
E. Section of the basilar process.
F. Foramen giving passage to a nerve.
G. Groove lodging the glosso-pharyngeal nerve.
H. Lateral sinus.
I. The greater cornu of the hyoid bone.
J. The thyroid gland.
K. Muscle.
L. Muscle.
M. Sterno-cleido-mastoideus muscle.
N. The superior constrictor of the pharynx.
O. The middle constrictor of the pharynx.
P. The inferior constrictor of the pharynx.
Q. Section of the posterior wall of the pharynx.
R. Cephalo-pharyngeal aponeurosis.
S. Section of the muscles in front of the vertebræ.
T. Section of the cellulo-fibrous tissue placed behind these muscles.

1. Section of the inferior thyroid artery.
2. Section of the common carotid artery.
3. Internal carotid artery.
4. Superior thyroid artery.
5. Lingual artery.
6. Inferior pharyngeal artery.
7. Section of the internal jugular vein.
8. Section of the external jugular vein.
9. Thyroid vein anastamosing with the pharyngeal plexus of veins.
10. Vein situated near the median line of the posterior wall of the pharynx.

11. Section of the glosso-pharyngeal nerve.
12. Section of the pneumo-gastric nerve.
13. Superior laryngeal nerve.
14. Section of the inferior laryngeal nerve.
15. Section of the spinal nerve.
16. The spinal nerve external to the internal jugular vein.
17. Section of the hypo-glossal nerve.
18. The sympathetic nerve.
19. The superior ganglion of the sympathetic nerve.
20. The middle ganglion of the sympathetic nerve.
21. Nervous plexus of the pharynx.
22 to 34. Vessels and lymphatic ganglions of the neck and of the lateral parts of the pharynx.

RIGHT SIDE.

A. Superior cornu of the thyroid cartilage.
B. Cricoid cartilage.
C. Cartilage of the epiglottis.
D. Cartilage of the Eustachian tube.
E. Septum of the nasal fossæ.
F. Pharyngeal opening of the right nasal fossa.
G. The uvula.
H. The base of the tongue.
I. The right tonsil.
J. Section of the mucous membrane of the soft palate.
K. Section of the mucous membrane of the tongue.
L. Section of the posterior wall of the pharynx.
M. Muscular fasciculus passing from the Eustachian tube to the velum.
N. The azygos uvulæ muscle.
O. Muscular fasciculus passing from the Eustachian tube to the pharynx.
P. The palato-pharyngeus muscle.
Q. The crico-arytænoideus lateralis muscle.
R. The crico-arytænoideus posticus muscle.
S. Section of the muscles in front of the vertebræ.

1. Ramifications of the ascending pharyngeal artery.
2. Branch of the ascending pharyngeal artery.
3. Artery coming from the superior thyroid.
4. Artery forming an anastomosis between the superior and inferior laryngeal artery.

5. Vein accompanying the ramifications of the inferior pharyngeal artery.
6, 7. Superior laryngeal veins.
8. Vein forming an anastomosis between the laryngeal veins.
9. Superior laryngeal nerve.
10. Inferior laryngeal nerve.
11. Anastamosis between the superior and inferior laryngeal nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Naso-pharyngeal or supero-pharyngeal polypi occupy the upper part of the pharynx and are attached to the base of the cranium on a level with the body of the sphenoid and occipital bones to the inferior surface of the basilar process. They are not therefore situated in front of the vertebral column, nor do they arise from the bodies of the vertebræ or from the intervertebral substance of the cervical region as was formerly supposed. They commence in the fibro mucous tissue which is situated behind and on the inner side of the Eustachian tube and which is normally of considerable thickness. Originating in this dense tissue, they are very hard from the commencement, but afterwards the mucous membrane covering them becomes more vascular, as well as their proper tissue, and hence they may give rise to profuse hæmorrhages. In consequence of their position they correspond to the posterior nares, and to the posterior surface of the velum, so that they soon enter the nasal fossæ and depress the velum.

Excision is the best means of treating them; if, however, we could make use of the ecrasseur it should be preferred to excision. The excision can only be accomplished by dividing the velum and excising the palatine arch (Nélaton). The base of these polypi cannot always be entirely extirpated, and although the operation may be well done, it is occasionally followed by a kind of fleshy growth from the cut surface, so that in order to ensure a cure, it is necessary to cauterize the part, either with nitric acid applied by means of a glass tube, or with Canquoin's paste (chloride of zinc) applied in a similar manner.

The pharyngeal mucous membrane is frequently the seat of follicular inflammation which is very difficult to cure, it occurs in persons who speak much in public and especially in smokers and those who take snuff. It is sometimes sufficient to remove the exciting cause to affect a cure.

The capacity of the pharynx would seem at first to exclude the idea that it could contain foreign bodies and yet it is not uncommon to meet with them in this cavity. If these substances are large, it is obvious they cannot penetrate into the œsophagus or into the air passages; they obstruct the passage of the air and death soon follows, unless they are removed. It is in this manner that some insane persons die. If the body is small, the same accident does not happen because it is either speedily swallowed or expelled. But although the body may be small, it may become

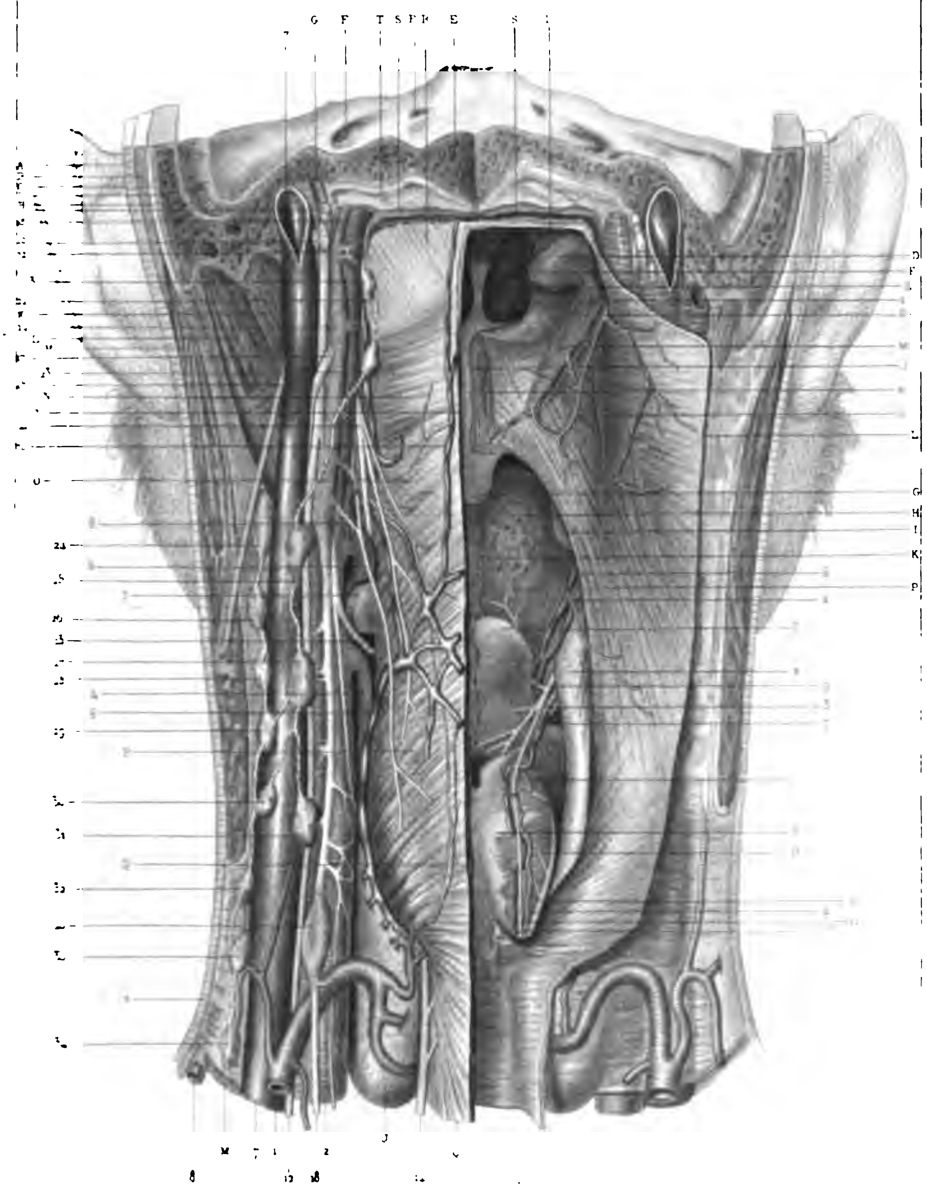

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FIG. 1

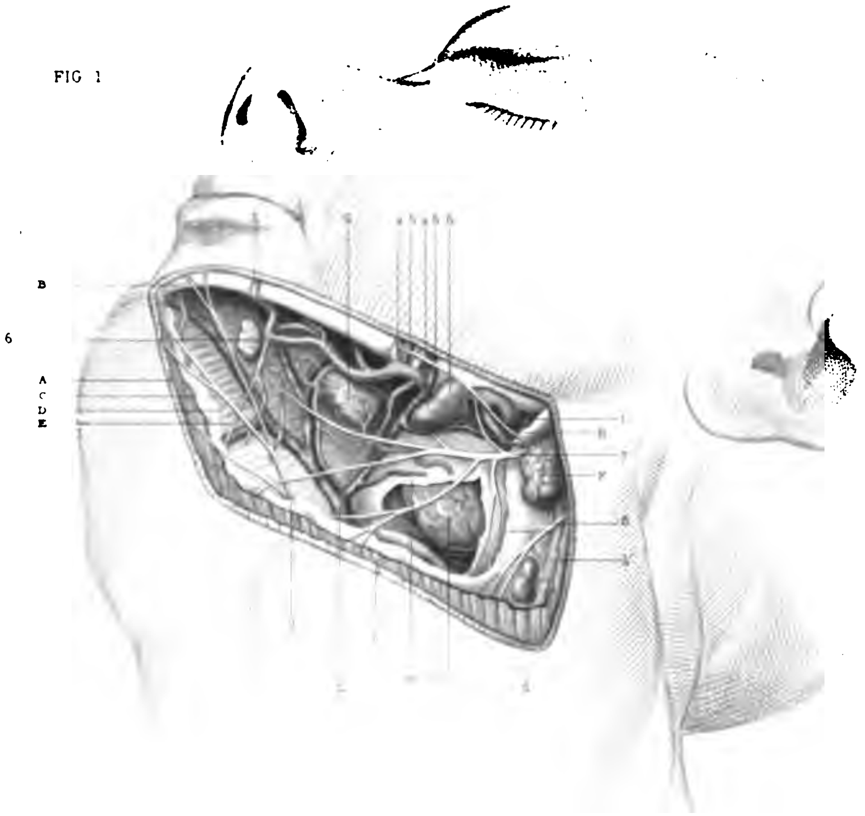

FIG. 2

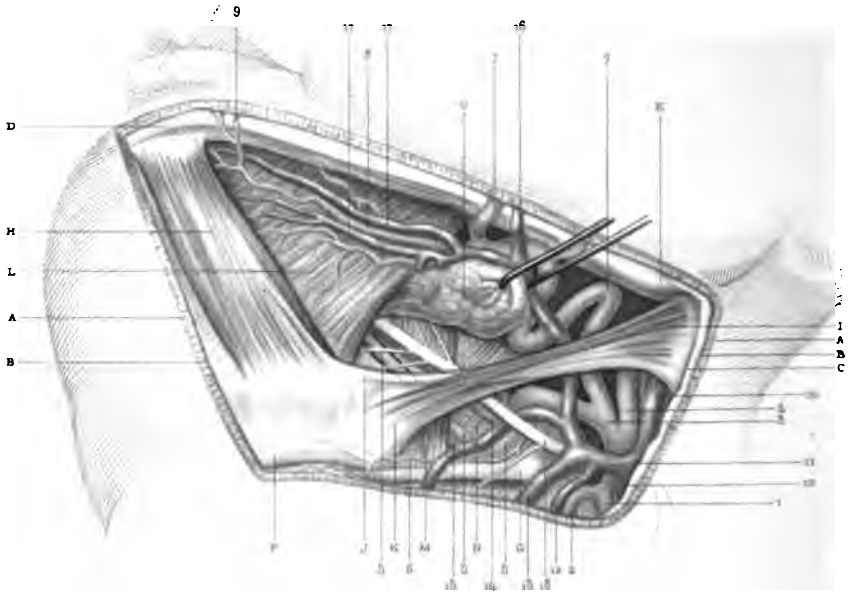

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PLATE XXXI.

FIGURE 1. — Sub-hyoid or sub-maxillary Region.

Superficial Layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Inferior maxillary bone.
C. Section of the platysma myoides muscle.
D. Section of the superficial fascia.
E. Sub-hyoid aponeurosis.
F. Inferior extremity of the parotid gland.
G. Sub-maxillary gland.
H. Section of the aponeurosis which forms the capsule of the sub-maxillary gland.

1. The horizontal or sub-maxillary portion of the facial artery.
2. Facial arteries two in number (irregular) passing from the neck to the face.
3. Submental artery and its terminal branches.

4, 4′. Principal origins of the external jugular vein.
5, 5′. Facial veins.

6, 6′, 6″, 6‴. Sub-maxillary lymphatic glands.

7. Cervical branch of the facial nerve.
8. Another cervical branch of the facial nerve going to platysma myoides muscle
9. Transverse branch of the cervical plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Hidden, so to speak, beneath the jaw, this region is brought into view when the head is turned back, and it is the position which must be given to the region when we wish to examine or perform an operation upon it.

The lymphatic glands are large and four in number. They receive the lymphatic vessels from nearly all the regions of the face, principally from the labial, nasal, and buccal regions, &c. Inflammations and every variety of degeneration which occur in these parts affect these glands, and hence the frequent occurrence of inflammation of the glands beneath the jaw. These inflamed glands often suppurate, and the abscess is then placed between the sub-maxillary aponeurosis and the skin, from which it is separated by the deep layer of the superficial fascia, the platysma myoides and the superficial layer of the superficial fascia. These abscesses consequently speedily project beneath the skin. There is no risk incurred in opening them, because the facial artery, which is the only one in the neighbourhood of the glands, is situated deeper than they are. In the chronic affections of the skin, of the mucous membrane, of the teeth, of the nose, of the eyes, termed *scrofulous affections* the suppuration of these glands is slow, and hence arises a more or less extensive thinning and separation of the skin and of the platysma myoides, which remain for a long time without healing. The lymphatic glands may become swollen, very large, and indurated forming prominent and unsightly tumours beneath the jaw. When local applications or internal remedies are unsuccessful in removing them, they may be broken down by means of a needle passed beneath the skin, in the same way as cataract of the crystalline lens is broken down, or they may be crushed by the forceps after they have been exposed. Their extirpation is not always easy, not only when they are very large, but when they are numerous and vascular, and form a continuous chain which ascends to a greater or less height beneath the jaw and surrounds the facial artery so intimately that it is very difficult to isolate it.

The facial artery in the sub-maxillary region is deeply situated and protected at its commencement by the stylo-hyoid and digastric muscles, then by the prolongations of the parotid and its aponeurosis; further on by the lymphatic glands and inferior margin of the jaw. This explains why this artery is seldom wounded. The surgeon, however, is liable to wound it in operating for the removal of diseased glands, or for the partial or complete resection of the lower jaw. When this happens, the two ends of the artery must be sought for and tied.

The application of a ligature to the facial artery is sometimes performed in the dissecting room; but it is more as a matter of exercise than of practical application, since compression of the artery against the lower jaw is always easy, and speedily arrests the bleeding from a wound of the face.

The following is the manner in which the ligature is to be applied. An incision should be made along the margin of the jaw from three to four centimetres (1·181 to 1·474 English (inch) in length, so that the centre of the wound corresponds to the depression which the margin presents in front of the masseter muscle. After dividing the skin the subcutaneous fascia is cut through and then the platysma myoides. The deep layer of the fascia is thus reached which is divided upon a grooved director and the artery exposed. The artery is very moveable, and for this reason care must be taken not to displace it from the groove in which it rests.

FIGURE 2. — Sub-hyoid, or sub-maxillary Region.

Deep Layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the platysma myoides muscle.
C. Section of the superficial fascia.
D. Inferior maxillary bone.
E. Angle of the lower jaw.
F. Body of the os hyoides.
G. Greater cornu of the os hyoides.
H. Anterior belly of the digastric muscle.
I. Posterior belly of the digastric muscle.
J. Reflected tendon of the digastric muscle.
K. Stylo-hyoid muscle.
L. Mylo-hyoid muscle.
M. Hyo-glossus muscle.
N. Muscular fibres of the genio-glossus muscle.
O. The sub-maxillary gland drawn aside to show the lingual artery.

1. External carotid artery.
2. Superior thyroid artery.
3. Common trunk of the facial and lingual artery.
4. External carotid after the origin of the facial and the lingual arteries.
5, 5′. The lingual artery and its relations with the hyo-glossus muscle and the greater cornu of the os hyoides.
6. Sub-hyoid branch of the lingual artery.
7. Facial artery.
8. Submental artery.
9. Mental branch of the submental artery.
10. External jugular vein.
11. Submental, facial, and lingual veins passing to enter the external jugular vein.
12, 13 Superior thyroid veins.
14. Lingual veins passing above the hyo-glossus muscle.
15. Another lingual vein accompanying the artery of the same name.
16. Facial vein.
17. Submental vein.

18. Hypo-glossal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The sub-maxillary gland is here contained in its aponeurotic covering. It should be borne in mind that in the female the lower margin of this gland, which forms our first guiding point descends much lower than in man. This gland is subject to hypertrophy mostly in smokers Fistula may form in the lobules of the gland or in one of the principal branches of its duct; M. Nélaton met with a case where it was congenital and opened in this region. Cauterisation with Conquoin's arsenical paste, through the whole of the fistulous track is the best method of treatment.

The lingual artery traverses the inferior and deep portion of the region, just as the facial artery traverses the superficial and superior portion. The application of a ligature to the lingual artery is necessitated by vascular tumours and especially by cancer of the tongue, for the purpose of preventing hæmorrhage during their removal. The operation which was formerly so difficult, is in the present day one of the most simple, if we take for our guidance the points of reference established by M. Malgaigne. An incision is to be first made parallel to the os hyoides and somewhat above it, commencing a little to one side of the median line and terminating at the angle of the lower jaw. The skin, the fascia, and the platysma are divided, and we then meet with the lower border of the gland, which descends to different depths in different individuals, the capsule of the gland is opened and it is then given in charge of an assistant to raise up during the remainder of the operation. This first step in the operation should be performed with care in order to avoid wounding the gland, which might give rise to a fistula. When the gland is raised, a second guiding point is met with in the tendon of the digastric muscle. Above this tendon there is a triangular space, bounded below by the tendon, internally by the external margin of the mylo-hyoid muscle, and above by the hypoglossal nerve. It is within this space that the lingual artery must be sought for. The hypoglossal nerve forms the third guiding point. This space being reached with the point of the bistouri we cut through a thin aponeurotic layer which covers the triangle, and we can then slightly separate the nerve above, and the tendon of the digastric below. The fibres and external margin of the hyo-glossus muscle are thus brought directly into view. This forms our fourth guide. A grooved director is then to be passed beneath the external margin of the muscle in the direction of the artery, and the fibres of the muscle are to be cut across in the same manner as we open the sheath of an artery. After dividing the muscle, the artery is seen accompanied by a vein, as in the present instance, or by itself. In the drawing, one vein accompanies the hypoglossal nerve and another the artery; but it is more usual to find the two veins along with the nerve.

One difficulty in the application of the ligature arises from the constant movements communicated to the parts through the acts of deglutition and respiration, and from the cries of the patient. If this should form a serious impediment to the performance of the operation, it may be easily overcome by fixing the os hyoides with a tenaculum.

The operation for removal of cancer of the tongue may be performed through the sub-hyoid region (proceeding of M. J. Cloquet and M. Mirault of Angers). Latterly M. Chassaignac has employed the écraseur for this purpose applying it through this region. Whatever plan is adopted, ligatures are passed through the median line of the region, that is to say, where there are few vessels of any importance.

The os hyoides forms the skeleton of the region; it is moveable, and yielding, and suspended amidst the numerous muscles to which it gives attachment, it is moreover protected by the lower jaw, and yet it is not impossible for it to be fractured as is shown by the cases of MM. Orfila, Cazauvieilh, Lalesque, Dieffenbach, Auberge and Marcinkowski.

Are the movements of the several pieces which form the hyoid bone such as to render them capable of being dislocated? Without admitting the case recorded by Valsalva, which is not convincing, it seems to us that the observations of Molinelli prove the existence of a true dislocation of one of the cornu upon the body of the bone.

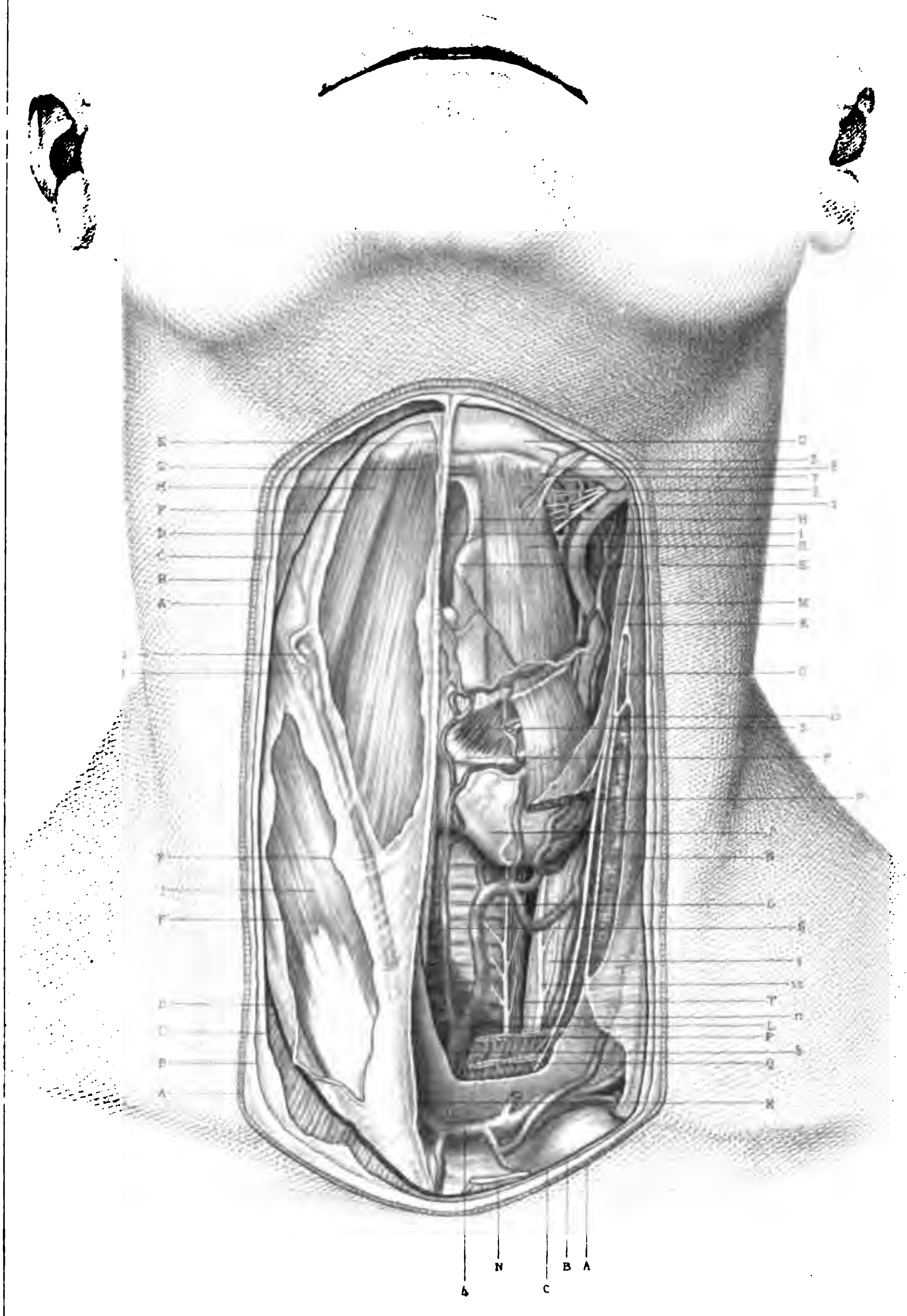

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PLATE XXXII.

Sub-hyoid Region, or Region of the Trachea

EXPLANATION.

RIGHT SIDE.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Section of the aponeurosis of the platysma myoides muscle.
D. Section of the platysma myoides.
E. Body of the hyoid bone.
F. Section of the superficial aponeurosis of the neck.
G. Sterno-hyoid muscle.
H. Omo-hyoid muscle.
I. Sterno-mastoid muscle.

1. Artery supplied by the superior thyroid artery.

2. Anterior jugular vein.

LEFT SIDE.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Section of the mylo-hyoid muscle and its aponeurosis.
D. Body of the hyoid bone.
E. Thyroid cartilage.
F. Cricoid cartilage.
G. Cartilaginous ring of the trachea.
H. Thyro-hyoid membrane.
I. Serous bursa situated behind this membrane.
J. Body of the thyroid cartilage.
K. Section of the superficial aponeurosis of the neck.
L. Section of the deep aponeurotic layer of the neck covering the sterno-hyoideus and the sterno-thyroideus muscles.
M. Section of this same aponeurosis in the upper half of the region.
N. Section of the sterno-mastoid muscle.
O. Section of the omo-hyoid muscle.
P. Section of the sterno thyroid muscle.
Q. Section of the sterno hyoid muscle.
R. Thyro-hyoid muscle.
S. Crico thyroid muscle.
T. Æsophagus.

1. Common carotid artery.
2. Superior thyroid artery.
3. Branch of the thyroid artery.

4. Venous trunk situated between the two layers of the aponeurosis of the neck, and receiving the sternal and anterior jugular veins.
5. Inferior thyroid veins.
6. Vein forming a communication between the superior and inferior thyroid veins.
7. Sub-hyoid vein.

8. Branch of the hypo-glossal nerve going to the thryo-hyoid muscle.
9. Superior laryngeal nerve.
10. Descending branch of the hypoglossal nerve.
11. Recurrent or inferior laryngeal nerve.
12. Sympathetic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds are of very frequent occurrence in this region; many suicides are effected by wounds of the larynx or of the trachea. These wounds are almost always incised wounds, presenting some difference according as they occupy the thyro-hyoid, laryngeal, or tracheal region. Wounds of the thyro-hyoid region may lay open the bucal and pharyngeal cavities if the instrument with which they are inflicted is carried upwards and backwards. If the instrument is carried downwards and backwards, the epiglottis will be divided either at its base or in the middle; when this is the case, a portion of the mucous membrane or of the epiglottis may obstruct the air passages and give rise to asphyxia. The discharge of the mucous secretion of the mouth, of fluids, and of food through the wound impedes deglutition, phonation, and respiration; such are the physiological symptoms of these wounds. The constant movements of deglutition and respiration, the depression and elevation of the jaw produce a wide separation of the margins of the wound. Union is here indicated, but it may produce some inconvenience and prevent the exit of the mucous secretion; it is for this reason that the angles of the wound should not be united if it is very extensive.

Wounds of the larynx present several varieties, sometimes they involve the vocal cords while at other times these organs are not impaired; the voice is destroyed if the wound is below the vocal cords and in every case air issues at the time with a characteristic sound.

Wounds of the trachea are often accompanied with hæmorrhage and the blood may enter the bronchial tubes not only by its specific gravity, but also through the act of inspiration, and, if the œsophagus is divided at the same time, the food may enter the air tube; from this there may arise two causes of death. When the trachea is completely divided the two extremities retract in opposite directions, the lower one becomes concealed amidst the surrounding structures, air can no longer enter the lungs, and there is danger of immediate suffocation. As the trachea is surrounded by a cellular sheath, like the cellular sheath of an artery, it follows that the work of cicatrisation takes place in this external covering. The application of a ligature is condemned by all authors, yet it appears to us, that when the division is complete it is indispensable; but in order to avoid swelling of the mucous membrane, lining the trachea, the suture should only include the cellular sheath.

All these wounds may be followed by emphysema which will sometimes gradually extend over the whole body; this arises from the edges of the wound in the skin and those of the wound in the trachea not being parallel to each other.

These wounds may also be followed by fistulæ. In treating these we must distinguish between those occupying the thyro-hyoid region, and those which are situated below this part. M. Velpeau has observed that the first heal with difficulty, because the divided parts are very moveable. In treating the second kind of fistulæ, one of the following methods should be adopted: 1. Extension of the superior and inferior angles of the fistula, paring off the edges and bring them together by suture: 2. By means of a plastic operation: 3. By cauterisation. M. Velpeau cured an obstinate case of fistula by dissecting up a flap so as to form a plug and fixing it between the margins of the wound.

The thyroid gland being situated superficially and in front of the larynx, it is often injured by cutting instruments; these wounds are important in consequence of the hæmorrhage which ensues from the great vascularity of the part.

The œsophagus is deeply situated behind the trachea so that wounds of it are rare. Nevertheless, they have been met with, and they often complicate wounds of the larynx or of the trachea. These wounds are ind
issuing of the food and of fluids taken into the mouth. Position and the use of an œsophageal tube are th
will frequently effect a cure.

Inflammation and abscess of the thyro-hyoid region may occur. 1. Between the skin and the platysma myoides; 2. Beneath the platysma myoides; 3. Beneath the superficial aponeurosis; 4. Beneath the thyro-hyoid muscles; 5. In the thyro-hyoid serous bursa; 6. Beneath the mucous membrane of the larynx. Inflammations and deep seated abscesses, which may be either idiopathic or sympatomatic of some affection of the tongue, of the epiglottis, or of the thyroid cartilage, cause considerable impediment to the function of transudation and give rise to submucous infiltration, which presses back the epiglottis over the superior aperture of the larynx, and produces danger of suffocation. As soon, therefore, as the formation of pus is suspected, an incision should be made between the os-hyoides and the thyroid cartilage, passing through the fibrous thyroid membrane into the centre of the abscess. This constitutes the *sub-laryngeal bronchotomy* of Vidal. Tumours of the thyroid gland may be arranged under the four following varieties: 1. Hypertrophy; 2. Cysts; 3. Goitre; 4. Cancer.

All these tumours possess in common the character of producing enlargement of the anterior part of the throat.

Situated upon the thyroid cartilage, which forms a resisting surface, having the form of a wedge or shield, these tumours are compelled to take an anterior direction and thus the air passages are prevented from being compressed. Yet penetrating or suffocating goitre produces suffocation in consequence of making its way behind the sternum or the clavicle and so producing pressure upon the trachea. It is curious to find that if we fix such a tumour by means of the fingers above the sternum, suffocation does not occur; and hence the indication to retain the tumour permanently in this situation. (Bonnet.) What is the source of these tumours? Are they formed by the thyroid gland? We think not. The following is our opinion upon this point. We have described in the thesis of Mr. Houel in 1860, small glandular bodies, varying in size from that of a hemp-seed to that of a cherry, belonging by their colour, situation and structure to the thyroid gland, but at the same time distinct from it. These small thyroid bodies may become hypertrophied and give rise to tumours. We have seen one case which we communicated to Mr. Houel. We believe that these hypertrophied glands form the tumour in suffocating goitre.

It has been proposed to tie the arteries going to the thyroid gland, but it is only necessary to consider the number of these vessels, their anastamoses, and their anomalies to understand that such a proceeding would be useless.

The veins are not less numerous than the arteries and when the hypertrophy affects both these systems of vessels, it gives rise to a form of goitre termed *vascular*, which may simulate aneurism of the carotid, when it has a semi-lateral position, by its expansion and contraction, its partial obliteration on compressing the carotid, and by its blowing sound; but the free movement of the tumour, and its slight dilitation are sufficient to enable us to recognise its nature.

The presence of such a large number of vessels readily explains the facility with which effusion of blood may occur in the thyroid gland.

The cells and areolar spaces of the thyroid gland may become morbidly enlarged, forming cysts, whose presence is not uncommon.

The surgeon is occasionally called upon to catheterise the air passages, for the purpose of introducing air. This operation must be speedily performed. The drawing in Plate XXX, Figure 2 of Plate XXVIII, and Figure 2 of Plate XXIX are intended to show the anatomical conditions of this operation which is not unfrequently performed upon the apparently still born infant, and more rarely in the child and in the adult. The laryngeal tube must be held in the right hand in the same manner as the pen in writing, its small end is passed into the mouth, and its course directed by the finger, previously introduced; when it has reached the larynx it is inclined to the left commissure and by a few gentle movements endeavours must be made to lift up the epiglottis; having done this the instrument should be raised, and at the same time directed towards the median line in order that its extremity may enter the glottis. In order to prevent the return of the air which is driven in, various means have been suggested: 1. A disk of sponge, of skin, or of agaric placed on the tube, at from three to four centimetres (1·19 to 1·48 English inch) from its extremity; 2. Closing up the aperture of the larynx with the index finger; 3. Firmly closing the lips on both sides of the tube with the thumb and index finger of each hand while the two middle fingers close the nose by compressing the nostrils. We think the best plan is to place the index finger over the superior aperture of the larynx.

The superior opening of the larynx is surrounded by a fold of mucous membrane, which easily becomes infiltrated with pus or serum, giving rise to suffocation or to œdema of the larynx, the fold of membrane should either be divided by means of a curved bistouri or what is better, torn with the finger.

When the application of the catheter fails to introduce air into the bronchial tubes, recourse must be had to *laryngotomy* or *tracheotomy*. Laryngotomy may be performed in three ways. 1. Between the os hyoides and the thyroid cartilage *(sub-hyoidean laryngotomy)*; 2. By opening the thyroid cartilage *(thyroideal laryngotomy)*; 3. By dividing the membrane which separates the thyroid from the cricoid cartilage *(crico-thyroideal laryngotomy)*. These operations are seldom employed while tracheotomy is often performed.

In this plate may be studied the relations of the trachea with the thyroid gland, the œsophagus, the recurrent nerve, the various muscles and the aponeuroses: it is seen that a large vein is here placed in front of the trachea, which must almost inevitably be divided. If such a case should occur in practice, two ligatures should be placed on the vein before dividing it, the opening of the vein might otherwise be attended not only with the introduction of blood into the trachea, but also of air into the veins, as we ourselves witnessed in one case. Lower down is seen a transverse vein (4) which may be wounded if the incision is carried too low. With regard to the brachio-cephalic vein, it is here concealed by the sterno-hyoid and sterno-thyroid muscles.

The œsophagus is deeply placed and protected by the larynx and trachea so that it is but little exposed to injury from external wounds. On the other hand it is frequently liable to morbid changes, giving rise to stricture, produced either by alterations in its fibrous structure or by cancerous disease. These narrowings occur at that part where the œsophagus is naturally somewhat narrower, that is to say at its opening into the pharynx, and towards the inferior part of the cervical region: it is also at these points that foreign bodies become arrested. All these disorders may necessitate two operations, viz.: catheterisation, and œsophagotomy.

The relations of the superior opening of the œsophagus explain why we can introduce a sound into the canal, either through the nasal fossæ (Desault), or through the mouth. The œsophagus is placed behind the trachea, nearly in the median line, but inclining towards the left as it descends, so that the end of the sound should be directed a little to that side. When a foreign body is lodged in the œsophagus, there are three methods of relieving the patient. 1. First by propelling it onwards into the stomach; 2. By withdrawing it through the mouth; 3. By the operation of œsophagotomy.

Three ways have been proposed of opening the œsophagus: Guattani recommended that it should be sought for between the trachea and the sterno-hyoid and sterno thyroid muscles on the left side; Eckholt between the two external fasciculi of the sterno-mastoid muscle; lastly Boyer, between the sterno-mastoid and the sterno-hyoideus muscles.

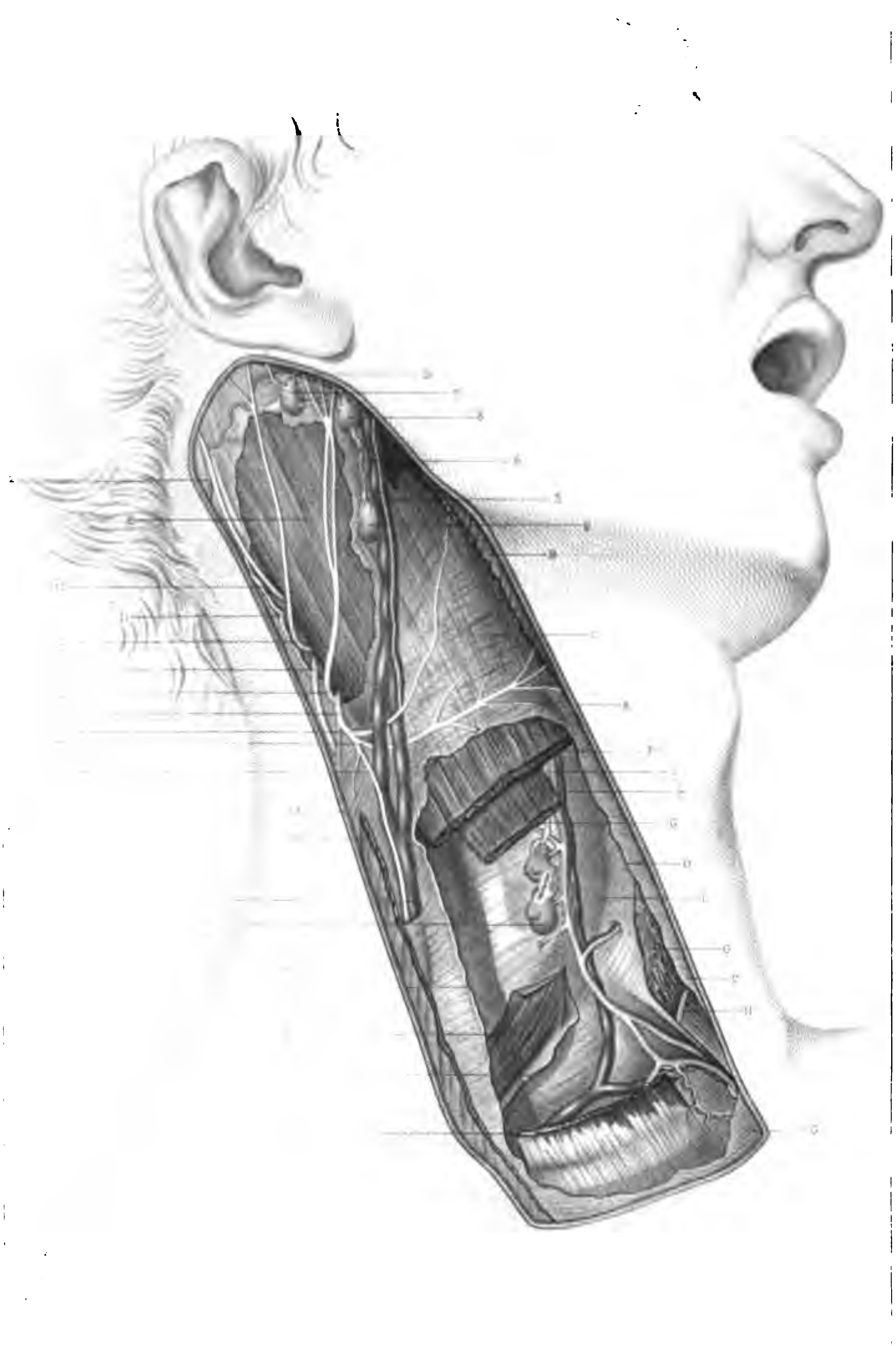

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PLATE XXXIII.

Sterno-Mastoid, or Carotid Region.

Superficial layer.

EXPLANATION.

A. Section of the skin covering the fascia.
B. Platysma myoides muscle
C. Aponeurosis of the neck, layer covering the sterno-mastoid muscle.
D. Section of this aponeurosis to show the sterno-mastoid muscle.
E. Sterno-mastoid muscle.
F. Clavicular fibres of the muscle.
G. Sternal fibres of the muscle.
H. Tendinous portion of the sternal fibres.
I. Deep layer of the sheath of the sterno-mastoid muscle.
J. Section of the aponeurotic layer to show the omo-hyoid muscle.
K. Omo-hyoid muscle.
1. Sterno-mastoid artery (a branch of the superior thyroid).
2. Sterno-mastoid artery (a branch of the occipital).
3. External jugular vein.
4. Sterno-mastoid vein.

5, 6. Lymphatic vessels.
7, 8, 9. Lymphatic glands placed upon the sheath of the sterno-mastoid muscle.
10. Lymphatic glands situated within the sheath, beneath the sterno-mastoid muscle.

11. Large mastoid branch.
12. Small mastoid branch.
13. Spinal nerve
14. Auricular nerve.
15. Common trunk of the transverse and descending branches of the cervical plexus.
16. Superior transverse branch.
17. Inferior transverse branch.
18. Descending branch of the cervical plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The external jugular vein traverses the region obliquely accompanied above and below by a branch of the cervical plexus of nerves so that it is difficult to open it without at the same time dividing some of the filaments of these nerves. Above it is covered by vessels and lymphatic glands. This vein is not subcutaneous; it is separated from the skin not only by the superficial fascia, but also by the platysma myoides and by a layer of the cervical aponeurosis. If it is opened, the wound should be made in a transverse direction in order to cut across the fibres of the platysma, if they were divided longitudinally they would close up the aperture of the wound and a thrombus would be formed.

The sterno-cleido mastoideus occupies the entire extent of the superficial layer of this region, to which it has given its name. It is important to be acquainted with the relations and structure of this muscle because it is liable to diseases requiring surgical operations.

In dividing this muscle the head should be first inclined towards the opposite side. The muscle is enclosed in an aponeurotic sheath; it is covered by the skin, the subcutaneous fascia, the platysma and the superficial layer of the cervical aponeurosis; in this layer we meet with the jugular vein and the descending, ascending and transverse nerves of the superficial cervical plexus. Within, it is in connection with the carotid arteries and the deep nerves of the neck, also with the internal jugular vein and with the anterior jugular veins when they exist. These organs lie beneath the muscle towards its superior and middle portions, and it is for the purpose of separating it from them, that it is advisable to extend the muscle before dividing it. It must be observed that within the sheath of the muscle we meet with a lympathic gland which by its inflammation will produce special derangements that have probably been hitherto attributed to the muscle itself, such as induration, suppuration, and abscesses in the substance of the muscle. Moreover, within this sheath there is an artery and a large vein which are necessarily divided at the same time as the muscle. From fifteen to twenty centimetres (5.9 to 7.8 inch) above the sternum, the sterno-cleido mastoideus muscle is separated from the deep vessels and nerves by the omo-hyoideus muscle, and is not covered by the external jugular, so that this situation is the one which should be selected for the purpose of dividing it. Below, it is separated from the vessels by the sterno-hyoideus and sterno-thyroideus muscles. This being the case, it is immaterial in making the section whether we pass the knife beneath the skin or beneath the muscle, on its inner or on its outer side. It is the sternal fascia which is generally retracted and which should be divided.

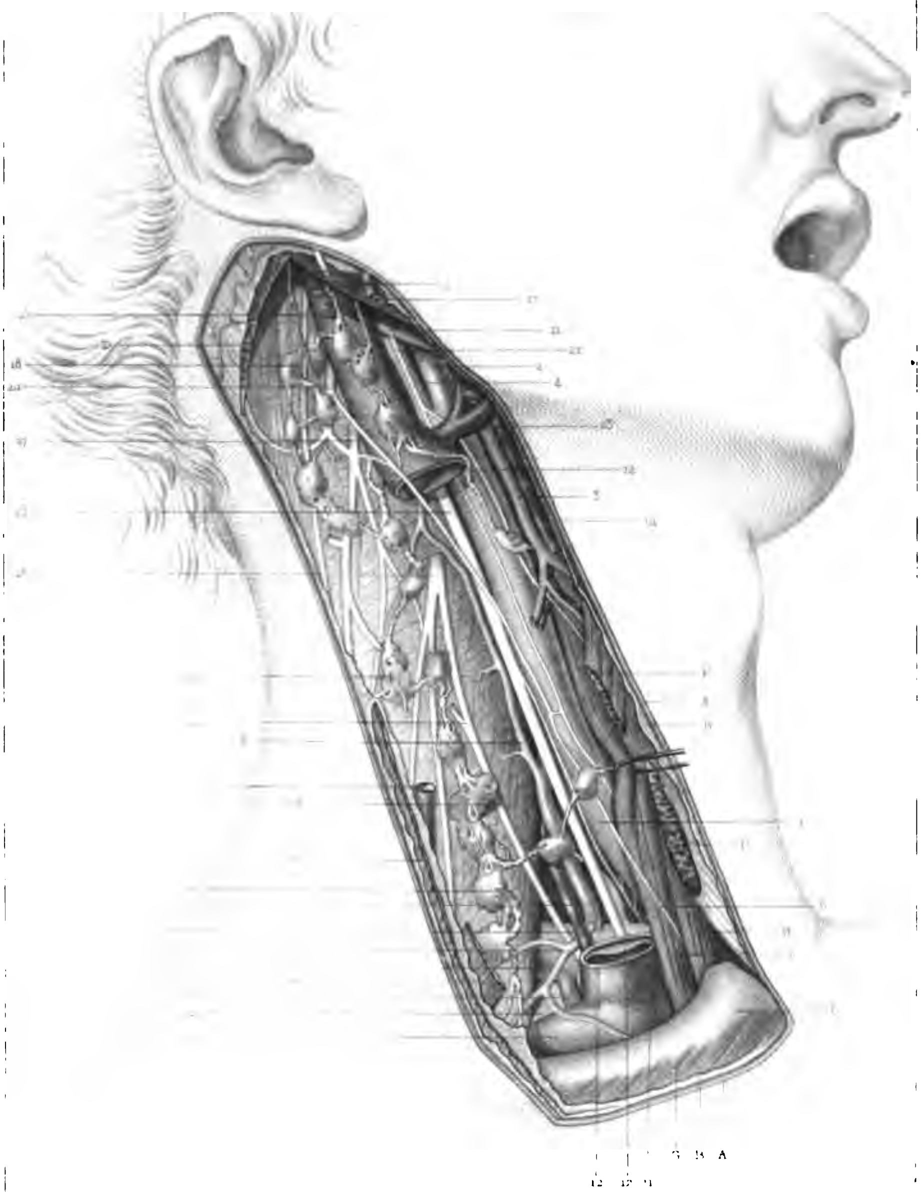

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PLATE XXXIV.

Sterno-mastoid or Carotid Region.

Deep layer.

EXPLANATION.

A. Section of the skin covering the fascia.
B. Superficial aponeurosis of the neck.
C. Clavicle.
D. Section of the sternal fibres of the sterno-mastoid muscle.
E. Section of the platysma myoides muscle.
F. Section of the omo-hyoid muscle.
G. Great pectoral muscle.
H. Sterno-hyoid muscle.
I. Sterno-thyroid muscle.
J. Posterior belly of the digastric muscle.
K. Anterior scalenus muscle covered with its aponeurosis.

1. Common carotid artery.
2. External carotid artery.
3. Superior thyroid artery.
4. Internal carotid artery.
5. Subclavian artery.
6. Vertebral artery.
7. Inferior thyroid artery.
8. Ascending cervical artery.
9. Common trunk of the supra-scapular and the posterior scapular artery.
10. Internal mammary artery.
11. Right brachio cephalic vein.
12. Section of the internal jugular vein.
12'. Valve of this vein.
13. Lingual vein receiving the superior thyroid veins and emptying itself into the internal jugular.
14. Superior thyroid vein.
15. Inferior thyroid vein.
16. Subclavian vein passing in front of the scaleni muscles.
17. Section of the external jugular vein.

18, 19, 20. Lymphatic glands situated beneath the deep layer of the sheath of the sterno-mastoid muscle.

21. Hypo-glossal nerve.
22. Descending branch of this nerve.
23. Pneumogastric nerve.
24. Phrenic nerve.
25. Spinal nerve.
26, 27, 28. Deep branches of the cervical plexus of nerves.
29. Apex of the right pleura.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The whole of this region is traversed by numerous vessels, many of which are of large size. The carotid, subclavian and jugular arteries and their branches may be wounded by cutting instruments, and when this is the case they will afford such an amount of hæmorrhage as speedily to cause death. If the surgeon is summoned at the time, he should endeavour to discover the injured vessels, and place a ligature above and below the wound. In such cases the search for the wounded vessel is very difficult owing to the infiltration of blood into the soft tissues of the neck. When any of the large vessels are merely punctured, or when the wound is small and has a transverse direction, the hæmorrhage may be arrested spontaneously, but a primary or consecutive false aneurism often forms. or it may be an arterio-venous aneurism when the wound has involved both the carotid artery and the internal jugular vein.

The vertebral artery, the thyroid arteries, and the lingual at its origin are also liable to be wounded; as before, the wounded vessel must be sought for and a ligature applied.

Wounds of the veins of the neck not only expose the patient to all the dangers attendant upon hæmorrhage, but also to a special danger which is met with in all veins in the neighbourhood of the thorax; we refer to the introduction of air into the veins. This is owing to the circumstance that bands of the aponeurotic membranes keep the mouths of the vessels open, so that in a manner they resemble the trachea, and when the art of inspiration draws the air into the chest, it causes it to enter the veins as well as the trachea. Compression with the finger and the subsequent application of a ligature to the vein is the means to be employed in the treatment of these accidents.

The nerves belonging to the region are very numerous and may be wounded or divided during an operation or accidentally by some cutting instrument. At the same time the great depth at which the pneumogastric, spinal, glosso-pharyngeal, hypoglossal, and sympathetic nerves are placed renders injury of them alone extremely rare, so that science does not possess any detailed accounts of the effects of these injuries. A ligature was applied on one occasion by Roux to the pneumogastric nerve, and symptoms of pulmonary congestion ensued (Fano). Physiology enables us to conjecture what would be the nature of the functional disturbances that would belong to each of these nerves. Division of the recurrent nerves is indicated by loss of voice, in the same way as when these nerves are pressed upon by a tumour.

Superficial inflammation and abscess of the region presents nothing peculiar, but on the other hand, deep-seated inflammation and abscesses require careful attention on the part of the surgeon. When these inflammations are situated behind the sterno-cleido-mastoideus muscle, and beneath the cervical fascia, not being able to make their way to the skin, they easily penetrate towards the head or the thorax. It is this form to which Dupuytren applied the name of *large phelegmon of the neck*.

There are few regions where the lymphatic glands are more numerous than in the neck and in the region under consideration. They form an uninterrupted chain placed upon the sterno-cleido-mastoideus muscle, frequently resting on the common carotid and its two terminal branches. In applying a ligature to these vessels, the glands on account of their size sometimes cover them up and impede the operation, so that it is necessary to remove them in order to bring the vessels into sight. These glands are frequently altered either from local or constitutional causes, such as syphilis or scrofula. Local irritation is of frequent occurrence, and a few years ago M. H. Larrey pointed out that they became inflamed in soldiers from the pressure of the collar of the uniform. When the glands are hypertrophied, in consequence of their being restrained by the sterno-mastoid muscle they cannot make their way externally, and they compress the carotid artery and jugular vein or even the nerve, giving rise to serious functional disturbances. In a case of degeneration of these glands we once found, in 1818, that the tumour had surrounded the pneumogastric nerve, and caused the death of the patient. M. A. Richard in an interesting work has shown that certain cysts in the neck originate in the areolar tissue of the lymphatic glands. This able surgeon exhibited preparations in which the entire evolution of these cysts could be traced.

In this drawing may be seen the relations of the common carotid which does not give off any branch during the whole of its course. Ligature of the vessel may be performed above two centimetres (0.787 English inch) below its bifurcation, and this is the situation which should be selected, or the ligature may be applied below at least two centimetres above its origin. The internal border of the sterno-mastoid muscle forms the best guide to the situation of the vessels, which is covered below by the sterno-hyoid and the sterno-thyroid muscles, and towards the middle of the neck by the omo-hyoid. Below the artery is situated in front of the vertebral column, opposite the transverse processes. If in the living subject the swollen condition of the parts gives rise to any doubt as to the situation of the artery, we have a guide in the *carotid tubercle* pointed out by M. Chassaignac. This tubercle is formed by the projection on the anterior branch of the transverse process of the sixth cervical vertebra, it is much more distinct than any of the others, and is placed six centimetres (2·362 English inch) above the clavicle, beneath the internal margin of the sterno-mastoid muscle; it is easily felt after the first layers have been divided, and corresponds anteriorly and a little internally to the carotid artery. In order to employ it as a guide the neck must be placed perfectly erect, for the least movement of rotation is sufficient to modify the relative position of the parts.

In order to expose the internal and external carotids, an incision must also be made along the inner margin of the sterno-mastoid muscle. It is at this part that the glands are frequently placed in front of the vessels. Care must be taken not to wound the hypoglossal nerve which passes obliquely and almost transversely in front of the two carotids. Every anatomist is aware that the two carotids may be mistaken the one for the other. In order to avoid this error, it should be remembered that the external carotid is a little in front and on the inner side of the external. A simple means to distinguish the two vessels, is to compress the artery and watch the effect of this upon the temporal artery. While performing a surgical operation, we have another means, by observing if the vessel has lateral branches, and if it has, then it is the external carotid.

In applying a ligature to the carotids, we have frequently seen an error committed even by advanced pupils, and against which the surgeon should be on his guard. We know that the sheath containing the artery also encloses the jugular vein which is placed externally. The sheath is intimately united to the jugular vein, and in some parts it is even confounded with it through its fibrous expansions which are more developed the nearer we approach to the thorax. If this sheath is opened incautiously the vein may be implicated at the same time. We have seen in these cases the grooved director introduced into the vein, when it was supposed to be only in the sheath, and the pupil lay open the vein to a considerable extent. To avoid this accident I have recommended the practice of opening the sheath on its inner side, that is as far as possible from the vein. It is scarcely necessary to say that in exposing this artery we must avoid wounding or injuring the pneumogastric or sympathetic nerves, and also if possible the descending branch of the hypoglossal.

At Number 29 may be seen the apex of the lung and of the pleura on the right side, which thus explains the possibility of a penetrating wound of the chest occurring in this region, and also the application of percussion opposite the clavicle, or even a little above it. When emphysema is present, this portion of the lung ascends still higher.

muscular layers. Even when an abscess is directly beneath the skin it is not generally very prominent because of the great thickness of the skin; it extends in breadth, and hence the kind of constriction and the acute pains which accompany its formation, for the same reason it is necessary to open the abscess so soon as the presence of pus can be determined.

There is no region where boils and carbuncles occur so often as in the neck. The frequency of these disorders depends upon the thickness of the skin and the little extensibility of the layer of subcutaneous cellular tissue; they give rise to great pain in consequence of the number of nerves that are present and the extreme tenseness of the part by which they are always characterised. In some cases where a carbuncle cannot spread, it extends into the deep portion of the region reaching to the muscles, and when the dead part comes away the deep muscular layers are exposed to view. It is unnecessary to say that serious consequences and even death may be the result of a carbuncle.

Aponeuroses, fibrous tissue, ligaments and tendons are here very numerous, and there is nothing surprising in the development of fibrous tumours, some of which extend deep in between the muscular layers. Dupuytren operated on several whose ramifications extended to the spinous processes of the vertebræ.

The frictions and contusions to which the nape of the neck is exposed, explain why lipomatous and atheromatous tumours are so frequently present. When these tumours are small, there is no urgent necessity for interference because they may be concealed, but when they are large an operation should not be delayed.

The articulations between the two first vertebræ, and between the atlas and the occipital bone, are very complicated, and as they are also subjected to constant and repeated movements and often to violence, they sometimes become inflamed, and this inflammation passing into a chronic condition, gives rise to a white swelling producing local disorders that may be explained by the anatomy of the part. Thus the swelling and the displacement of the bones accounts for the compression of the spinal cord and the speedy death that it involves. In the same way may be explained the projection that occurs in the region below the occipital bone, and that which afterwards presents itself at the base of the pharynx. Functional disturbances, such as immobility of the head, pain on the slightest movement, causing the patient to hold his head between his hands when he wishes to rise in his bed, dysphagia, dyspnœa, &c., are easily understood by examining the relations presented by these articulations.

downwards, and if left under the control of its own weight, it would incline towards the left. What maintains the head in a state of equilibrium is the greater power of the muscles on the right side, over the muscles on the left side. May we not say, that a case of wry neck, arising from paralysis of the two sides, will always be characterised by the inclination of the head towards the left side?

The cervical vertebræ are deeply placed, also they are rarely fractured; nevertheless, falls upon the crown of the head, or upon the feet may cause a fracture.

The cervical vertebræ are connected by articular processes whose surfaces are nearly horizontal, while in the other regions the articular surfaces are very oblique and frequently vertical. It follows from this that dislocation without fracture can only occur in the cervical region.

The firmness of the occipito-atloid articulation does not depend upon the ligaments, but rather upon the relative position of the articular surfaces, which are disposed in the form of a cone locked in between other excavations that are of a cup-like form and placed obliquely. It follows from this arrangement, that the separation of the condyles of the occipital bone from the corresponding articular surfaces of the atlas is impossible without a wide separation of the two, a separation, says M. Richet, which can only take place when the ligaments connecting the occipital with the odontoid process and the axis, have been ruptured or this process fractured. But when this occurs, it is then a dislocation of the atlas from the axis, and not a displacement of the occipital bone from the atlas. M. Richet also correctly observes that an accidental dislocation of the head on the first vertebræ, if not impossible, is at least unknown to the present time, and that no well authenticated instance exists in the history of surgery.*

The articulation of the head with the vertebral column is such that its power of resisting extension is quite incredible. Even, when in order to make a dissection of this articulation, all the muscles have been removed, and all the bands of fibro-cellular tissue which surround and consolidate it, the articular surfaces can only be separated by the strongest efforts. We can therefore understand how difficult it is for the atlas to be dislocated by an accident from the axis without fracture. J. L. Petit and Louis consider that the instantaneous death which takes place in hanging is the result of the pressure caused by the dislocated odontoid process upon the anterior surface of the spinal cord. But, Roaldo Colombo, Mackenzie, Monro, Orfila, and Casper have shown that this supposed dislocation of the first upon the second vertebræ, as the result of hanging, rests upon no good foundation. If such is the state of the question in regard to hanging, we must not, however, regret the possibility of this dislocation under other circumstances. Thus M. Sédillot and M. Hérigoyen have each seen a case of accidental dislocation of the atlas and the axis without fracture of the odontoid process.

The bodies and articular processes of the five last cervical vertebræ are arranged so as only to allow of the movements of flexion and extension and slight lateral movements. Rotation does not exist, and in order to produce it the ligaments must be ruptured. These facts explain the mechanism of the dislocations of these vertebræ. M. Richet is right in declaring, contrary to the opinion of Boyer, that they are not the result of a movement of rotation. He has proved that dislocation forwards of the bodies or of the processes only occurs from exaggerated movements of flexion or extension, or from side to side. Thus, according to the surgeon of the Hospital of Saint Louis, complete dislocation forwards is caused by forced flexion of the cervical portion of the vertebral column in which the superior vertebra glides over the inferior until the superior articular surfaces project beyond the inferior, in front of which they become fixed. In order to produce a dislocation of the articular surfaces only, the head must be inclined forcibly to the right or to the left performing at the same time a slight movement of rotation, so that superior articular surface passes beyond the inferior, becomes fixed in front of it and cannot return so as to gain its original position. In this way we may conceive the occurrence of dislocation of these vertebræ without fracture.

Injuries of the spinal cord are not uncommon; they may be produced directly by means of cutting instruments, by tumours, or from displacement of the bones in dislocations or fractures. These injuries are more dangerous and more quickly fatal in proportion to their proximity to the medulla oblongata. Thus a cutting instrument which penetrated between the first cervical vertebra and the occipital bone would reach the medulla oblongata, the *centrum vitale* and cause instantaneous death. Every one is acquainted with the case recorded by J. L. Petit, of the father, who enraged by the death of his young son through the carelessness of a neighbour, threw a knife at the the man which penetrated between the first and second cervical vertebræ. The man died immediately. In proportion as the instrument injures the spinal cord lower down, the injured person lives longer, and may even recover. Wounds or injuries above the origin of the phrenic nerve, that is to say, between the third and fourth cervical vertebræ are always dangerous, because the action of this nerve being paralysed, respiration soon stops. In the cervical region the wound might also affect the spinal nerve and so cause very serious disturbance in the act of respiration.

The spinal cord may be the subject of malformations in the cervical region; we saw the case of an infant at the Maternité who had the cord diluted throughout the whole of this region, presenting in its centre a canal filled with purulent matter; this cavity was a persistent condition of the central canal of the spinal cord.

Hydrorachis or spina bifida is occasionally met with in the cervical region, but not so often as in the dorsal and acro-lumbar region. The cervical region at its upper part may be the seat of congenital encephalocele owing to want of unison of the two halves of the occipital bone and of the laminæ of the vertebræ.

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* A. Richet, *Des Luxations Traumatiques du Rachis.* Paris, 1851. p. 21.

FIG. 1

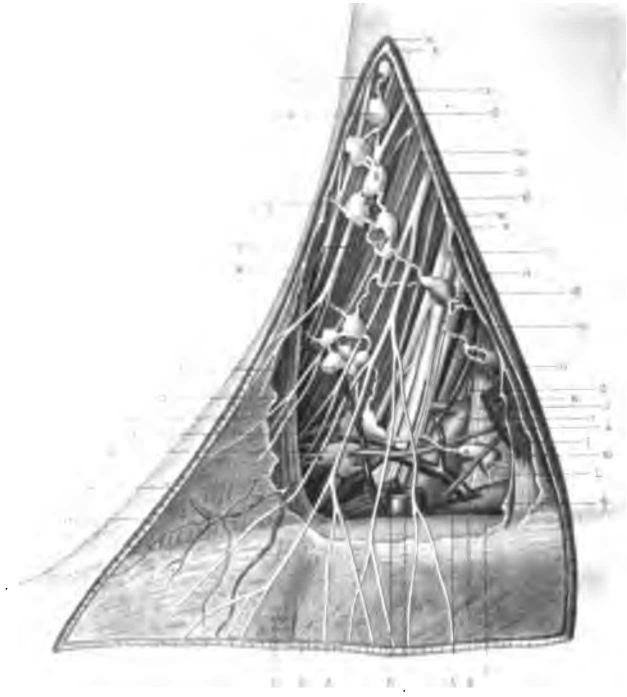
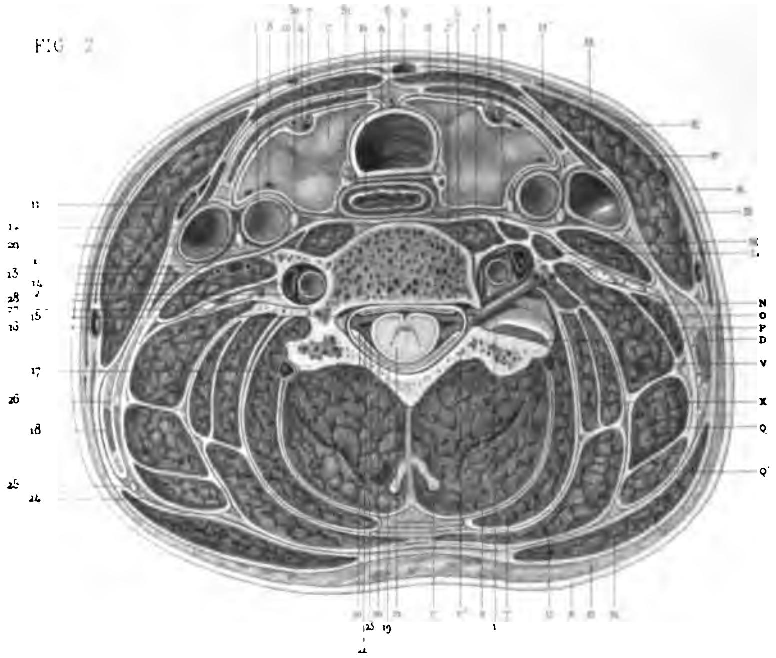


FIG. 2



LIBRAIRIE GERMER BAILLIERE

PLATE XXXVII.

FIGURE 1. — Supra-clavicular Region.

EXPLANATION.

A. Section of the skin bounding the supra-clavicular triangle.
B. Subcutaneous fascia.
C. Aponeurosis of the pectoralis major muscle.
D. Section of the aponeurosis of the trapezius muscle.
E. Section of the aponeurosis uniting the trapezius and the sterno-cleido-mastoideus, superficial aponeurosis of the region.
F. Layer of this aponeurosis covering the fibres of the platysma myoides muscle.
G. Another layer of this aponeurosis forming the aponeurotic sheath of the sterno-cleido-mastoideus.
H. Section of the platysma myoides.
I. Clavicular portion of the sterno-cleido-mastoideus muscle.
J. Anterior margin of the trapezius muscle forming the posterior boundary of the supra-clavicular triangular.
K. Section of the omo-hyoideus muscle.
L. The scalenus anticus muscle.
M. Anterior fibres of the scalenus posticus.
N. Posterior fibres of the scalenus posticus.
O. Clavicle.

1. Subclavian artery.
2. Posterior scapular artery.
3. Ascending cervical artery.
4. Supra-scapular artery.
5. A small undescribed artery, arising from the subclavian artery distributed to the muscles of the neck, principally to the omo-hyoideus muscle.

6. Subclavian vein.
7. Section of the external jugular vein.
8. Subscapular vein emptying itself into the external jugular vein.

9. Lymphatic vessels.
10. Lymphatic glands.

11. Spinal nerve.
12, 13, 14, 15, 16. Descending branches of the cervical plexus.
17, 18, 19. Origins of the brachial plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Inflammation and abscesses of the supra-clavicular region present three varieties. The first is situated in the cellular tissue, placed between the skin and the superficial layer of the cervical fascia. These abscesses are confined to the region, and present no special peculiarity. The second variety is placed between the superficial and middle layer of the cervical fascia. These abscesses will be confined beneath the superficial fascia which unites the corresponding margins of the trapezius and the sterno-cleido-mastoideus muscles. If they cannot readily make their way to beneath the skin, neither can they pass towards the deep parts in consequence of the impediment presented by the deep fascia. The third variety is placed beneath the deep fascia which surrounds the scaleni muscles, the subclavian artery and the brachial plexus. Abscesses caused by congestion, and which commence at the vertebral column, will easily make their way into the hollow of the axilla.

Wounds of the supra-clavicular region are of the greatest consequence, because of the important vessels and nerves which may be injured. It is sufficient to mention the possibility of the jugular veins, and the subclavian artery being wounded to form an idea of this. Wounds of this artery are sometimes the seat of dangerous aneurisms. Deep wounds may reach the inferior cul de sac of the pleura, and present the same danger as penetrating wounds of the chest.

Operations in the supra-clavicular region are probably more liable than those performed in other parts to be accompanied by the introduction of air into the veins. This depends upon the circumstance that nearly all the veins of the part are surrounded by aponeurotic sheaths derived from the neighbouring fasciæ, which keep them dilated; so that the air is drawn in with considerable force, in consequence of the proximity of the chest. The subclavian vein may be mentioned as one which is especially wide open: the expansion it receives being furnished by the aponeurosis of the subclavian muscle.

The lymphatic glands are arranged in three layers. The superficial glands, placed between the superficial and middle fascias are, most of them behind the clavicle, and receive the lymphatic vessels belonging to the lateral and superficial region of the neck, and of the neighbouring regions of the thorax and the shoulder. Whenever we find congestion of these glands we may conclude that irritation has been set up in these parts.

The middle glands are placed beneath the middle fascia parallel to the subclavian vein, they are continuous internally with the vertical chain of the deep cervical glands. They receive the lymphatic vessels coming from the axilla and the shoulder, and some of those from the lungs. It follows from this that chronic diseases of the lungs or of the pleuræ are frequently accompanied with congestion of these lymphatic glands.

The deep glands, one or two in number, are placed beneath the deep fascia, and are intimately connected with the subclavian artery. We exhibited at the *Société de Biologie* the lymphatic glands of this region in a state of hypertrophy taken from a female who was with child, and we have proved that the hypertrophied condition depends upon pregnancy.

This region communicates externally and inferiorly with the axilla, internally and inferiorly with the thoracic cavity. Hence, abscesses and aneurisms cannot be primarily developed here, nor can they reach this part until they have acquired a considerable size. The subclavicular region may be regarded as a common centre, where various tumours present themselves.

The conditions are not such as to favour the production of arterio-venous aneurisms. Thus the subclavian artery is separated from the vein of the same name by the anterior scalenus muscle, and by lax cellular tissue. The two vessels do not approach each other until they are about to pass beneath the clavicle: arterio-venous aneurisms therefore only occur at this part. We may mention two cases of Larrey's as examples of these aneurisms. Aneurisms of the subclavian region being repressed by the bones, and bound down by the muscles and aponeuroses, it is easy to foresee that their progress must be slow and difficult, and that the eccentric force which governs their developement must exercise an injurious influence over the neighbouring parts. Thus the clavicle is thrust forwards, and even as it were dislocated at its two articulations. It may be destroyed or worn away, but this rarely happens on account of its mobility: while the sternum, ribs, and vertebræ being more fixed are more frequently absorbed, or worn away. Instead, however, of wearing away the first rib, the tumour may make its way between that and the second, and project into the thoracic cavity (Seütin). All the muscles are more or less distended, compressed and confounded with the walls of the sac. The nerves also are pressed upon, and hence there arises disturbance in the sensation and motion of the parts to which the nerves are distributed. With regard to the phrenic nerve, this often escapes being pressed upon because it is protected by the internal border of the anterior scalenus muscle. The arteries and veins do not escape this compression; hence the absence of the arterial circulation when the artery is pressed upon, or stasis of the blood when the vein is pressed upon, the latter condition explains the varicose state of the veins and the swelling of the upper extremity. The pleura around these aneurisms becomes thickened and forms adhesions to the contiguous surface of the lungs. Moreover, in a case of M. Niret's of Nancy the apex of the left lung was encroached upon, the lower wall of the aneurismal sac was destroyed and the margin of the opening adhered to the circumference of a large cavity excavated in the substance of the lung. Ligature of the subclavian artery may be performed at three places, on the inner side of the scaleni muscles, between the scaleni, and on the outer side of these muscles. In the latter situation the application of the ligature is tolerably easy if we follow our guiding points. On reaching the subcutaneous layer, after dividing the skin, we must be careful not to wound the external jugular vein passing perpendicularly to the direction of the incision which is made parallel to the clavicle. If the vein is placed in the centre of the incision, it should be partially dissected out, and an assistant must then hold it by means of a retractor in one of the angles of the incision. After separating this vein we arrive at the superficial fascia, which is to be divided to the same extent as the external wound. We thus reach the omo-clavicular triangular and divide the aponeurosis which closes it up. This being done, with the assistance of a grooved director passed parallel to the artery, the cellular tissue and the aponeurotic sheath of the vessel, which is almost cellular, is to be slightly separated. We then seek for the tubercle of the first rib, which is easily felt on the external border of the inferior insertion of the anterior scalenus muscle. The finger is placed upon this tubercle, and we then know that the artery is immediately behind. Thus we have the inferior margin of the omo-hyoideus muscle, the external margin of the anterior scalenus muscle, and the tubercle of the first rib; these three points serve to guide us directly to the subclavian artery.

The application of the ligature between the scaleni requires the same kind of incision, but encroaching a little on the external margin of the sterno-cleido-mastoideus muscle, of which it is necessary to divide a portion. We then come upon the anterior surface of the anterior scalenus muscle beneath which the artery is situated. In dividing this muscle near its inferior attachment, it must be remembered that the phrenic nerve lies along its internal margin and is intimately connected with it. The fibres of the muscle must be raised up one after another, and not divided until it is clearly ascertained that the phrenic nerve is not included with them.

On the inner side of the scaleni the ligature of the subclavian artery presents so many dangers that surgeons have abandoned the operation. The relations of the region with the clavicle explains why fracture of this bone may produce compression of the subclavian artery and vein. M. Nélaton has proved that by carrying the head of the humerus backwards and forcibly depressing it, we can produce compression of the subclavian artery so as to arrest the course of the blood in the upper extremity. If we were called upon to arrest a hæmorrhage of the upper extremity, we must have recourse to this mode of compression in the absence of other means.

Figure 2. — Horizontal Section of the Neck on a level with the fourth cervical Vertebræ.

Aponeurosis.

EXPLANATION.

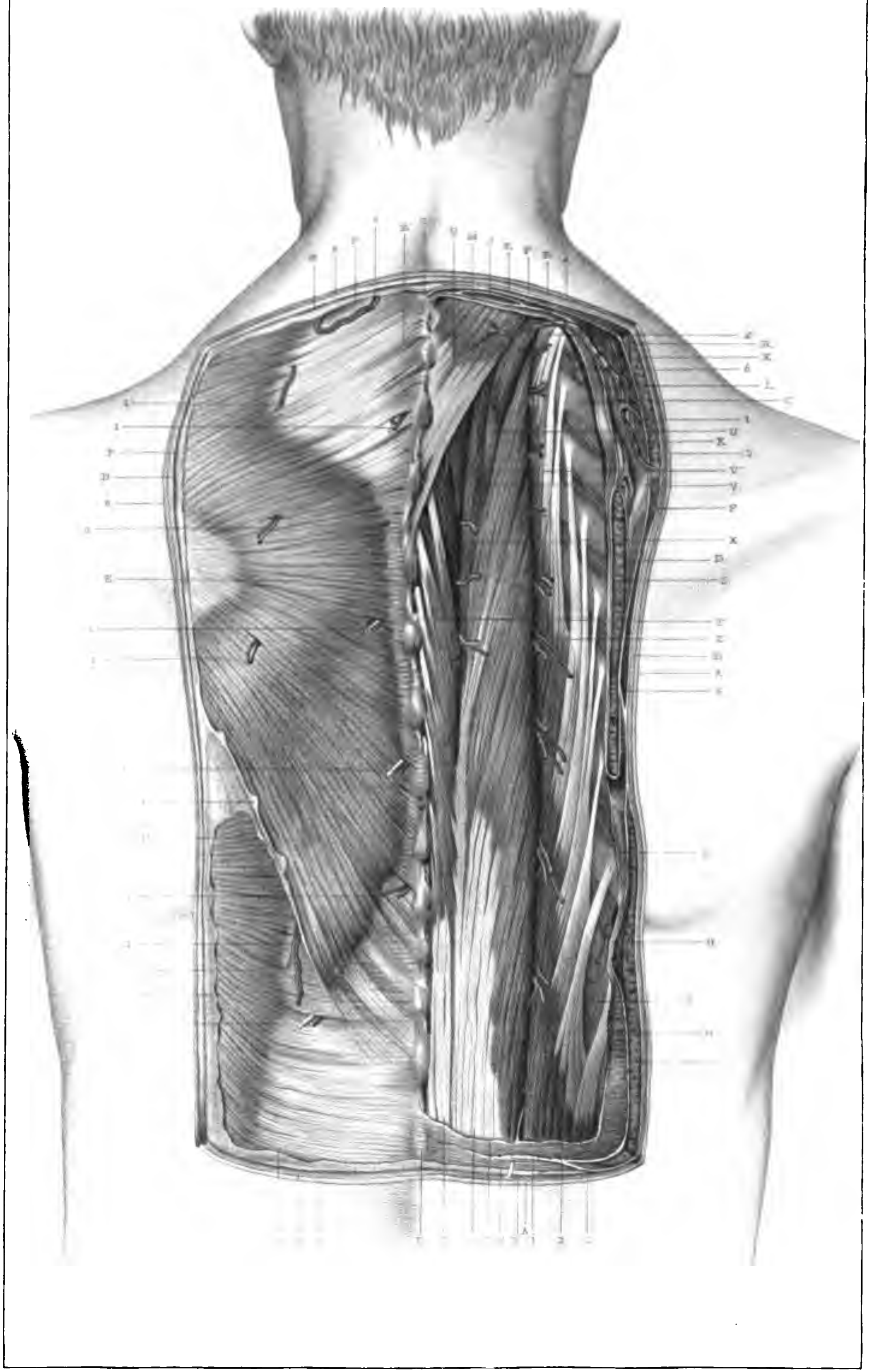
RIGHT SIDE.

A. Section of the skin of the neck.
B. Fatty subcutaneous cellular tissue blending with the superficial layer of the cervical aponeurosis of the neck on a level with the platysma myoides.
C. Section of the body of the fourth cervical vertebra.
C.′ Section of the tubercles of the spinous process of the fourth cervical vertebra.
C.″ Section of the right lamina of the same process.
D. Articular process of the fourth cervical vertebra.
E. Platysma myoides contained between the two layers of the superficial cervical fascia.
F. Sterno-cleido-mastoideus muscle.
G. Sterno-hyoideus muscle.
H. Omo-hyoideus muscle
H.′ Aponeurotic membrane uniting the sterno-hyoideus and the omo-hyoideus muscles.
I. Section of the sterno-hyoideus muscle.
J. Section of the longus colli muscle.
J.′ Aponeurosis of this muscle.
K. Section of the rectus capitis anticus muscle.
L. Fibres of the anterior intertransversalis muscle.
M. Section of the anterior scalenus *muscle.*
N. Section of the posterior intertransversalis muscle.
O, P. Section of the two fasciculi of the posterior muscle.
Q, Q. Section of two fasciculi of the levator scapulæ muscle.
R. Section of the trapezius muscle.
S. Section of the multifidus spinæ muscle.
T. Section of the complexus muscle.
U. Section of the splenius capitis muscle.
V. Section of the biventer cervicis muscle.
X. Section of the splenius colli muscle.

LEFT SIDE.

A. Transverse section of the trachea.
B. Section of the æsophagus.
C. Section of the thyroid gland.

1. Section of the common carotid.
2. Section of the vertebral artery.
4. Section of one of the thyroid veins.
5. Section of the ascending cervical artery.
6. Section of the inferior thyroid vein.
7. Section of a branch of the thyroid artery.
8. Section of a branch of the thyroid vein.
9. Section of the anterior jugular vein.
10. Section of a collateral branch of the anterior jugular
11. Section of an accessory vein of the internal jugular vein.
12. Section of the internal jugular vein.
13. Section of the ascending cervical vein.
14. Section of the vertebral vein.
15. Section of the venous sinus in the spinal canal.
16. Section of the external jugular vein.
17. Posterior deep cervical vein.
18. Lymphatic glands.
19. Section of the dura mater of the spinal cord.
20. Section of the arachnoid membrane of the spinal cord.
21. Section of the spinal cord.
22. Anterior root of spinal nerve.
23. Posterior root of spinal nerve.
24. Section of branch of spinal nerve.
25. Section of spinal nerve.
26. Section of one of the nerves of the cervical plexus.
27, 28. Section of the nerves of the brachial plexus.
29. Section of the pneumogastric nerve.
30. Section of the lymphatic nerve.
31. Section of the recurrent laryngeal nerve.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XXXVIII.

Dorsal Region.

Superficial Layer.

EXPLANATION.

LEFT SIDE (*first layer*).

A. Section of the skin bounding the region.
B. Section of the fatty subcutaneous fascia.
C. Spinous process of the first dorsal vertebra.
D. Spinous process of the first lumbar vertebra.
E. Trapezius muscle.
E′. Aponeurotic fibres of the trapezius.
F. Section of the aponeurosis of the trapezius muscle.
G. Latissimus dorsi muscle.
H. Section of the aponeurosis of the same muscle.

1. Section of the vessels and nerves passing to ramify in the integument.

RIGHT SIDE (*second layer.*)

A. Section of the skin bounding the region.
B. Section of the fatty subcutaneous fascia.
C. Third rib.
D. Posterior angle of the scapula.
E. Section of the trapezius muscle.
F. Aponeurosis of the trapezius muscle.
G. Section of the latissimus dorsi muscle.
H. Section of the aponeurosis of the latissimus dorsi muscle.
I. Section of the aponeurotic tendon of the latissimus dorsi muscle.
J. Section of the rhomboideus muscle.
K. Section of the aponeurosis of the rhomboideus muscle.
L. Section of the serratus posticus superior muscle.
M. Section of the aponeurosis of the same muscle.
N. Section of the serratus posticus inferior muscle.
O. Section of the aponeurosis of the same muscle.
P. Aponeurosis which unites the two serrati muscles.
Q. Splenius muscle.
R. Levator scapulæ muscle.
S. Longissimus dorsi muscle.
T. Interspinalis dorsi muscles.
U. Transversalis colli muscle.
V. Complexus muscle.
V′. External fibres of the complexus muscle.
X. Transversalis dorsi muscle.
Z. Sacro-lumbalis muscle.
a. Supplementary muscle to the sacro-lumbalis.
b. Second external intercostal muscle.

1. Posterior scapular artery and vein.
2. Branch furnished by the posterior scapular artery.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

A knowledge of the various elements belonging to the superficial layer affords us some useful information in relation to the pathology of the part.

The skin is here thick as in the posterior region of the neck, and like it, is liable to be the seat of carbuncle, and of furoncular and erisepelatous inflammation of a severe character. The subcutaneous cellular tissue being dense and fibrous prevents the spreading of the inflammation which is characterised by excessive pain.

The subcutaneous masses of muscle are large and extended, hence the diffuse form of the suppurations which sometimes attack the cellular tissue that separates them from each other, hence also, the necessity of opening these abscesses at an early period, and of facilitating the exit of the pus by the formation of numerous openings. Inflammations and suppurations situated in the deep layer of muscles have a difficulty in making their way beneath the skin; they are more apt to extend throughout the whole extent of the aponeurotic sheath which covers them, and only slowly show themselves at the more dependent part of the region or even in the lumbar region.

It has latterly been proposed to divide these muscles near their attachments to the vertebral column, but hitherto this operation has not come into use.

In the course of the median line of the region are seen the projections of the spinous processes. The series of these projections constitute what is termed the *dorsal spine.* It is useful to be acquainted with the manner in which these processes are distributed. In the normal state, they are regular, forming a slight curve having its convexity directed posteriorly, and of which the centre is situated in the middle third of the region. In persons who use their right hand, there is also normally a slight deviation to the right with a corresponding concavity to the left. The entire series of processes is visible beneath the skin, but by marking with ink or a pencil, each of the apices, the changes that take place in their relative positions are more easily observed. Thus when there is an irregularity in the vertebral column, we can, by the sight alone, but more certainly by marking with ink judge of the nature of the irregularity which occurs most frequently in children and in young girls at the period of puberty. This abnormal curvature of the spine takes place towards the right side, so that the inferior angle of the scapula on that side is slightly raised up. This convexity towards the right gives rise to a convexity in the opposite direction in the lumbar region; the latter deviation has been termed the *curve of compensation*. The irregularity is corrected by means of an apparatus, which resting on the pelvis as its point of support, presses the superior curvature inwards, and towards the left side, while it carries the lumbar curve, or curve of compensation in the opposite direction.

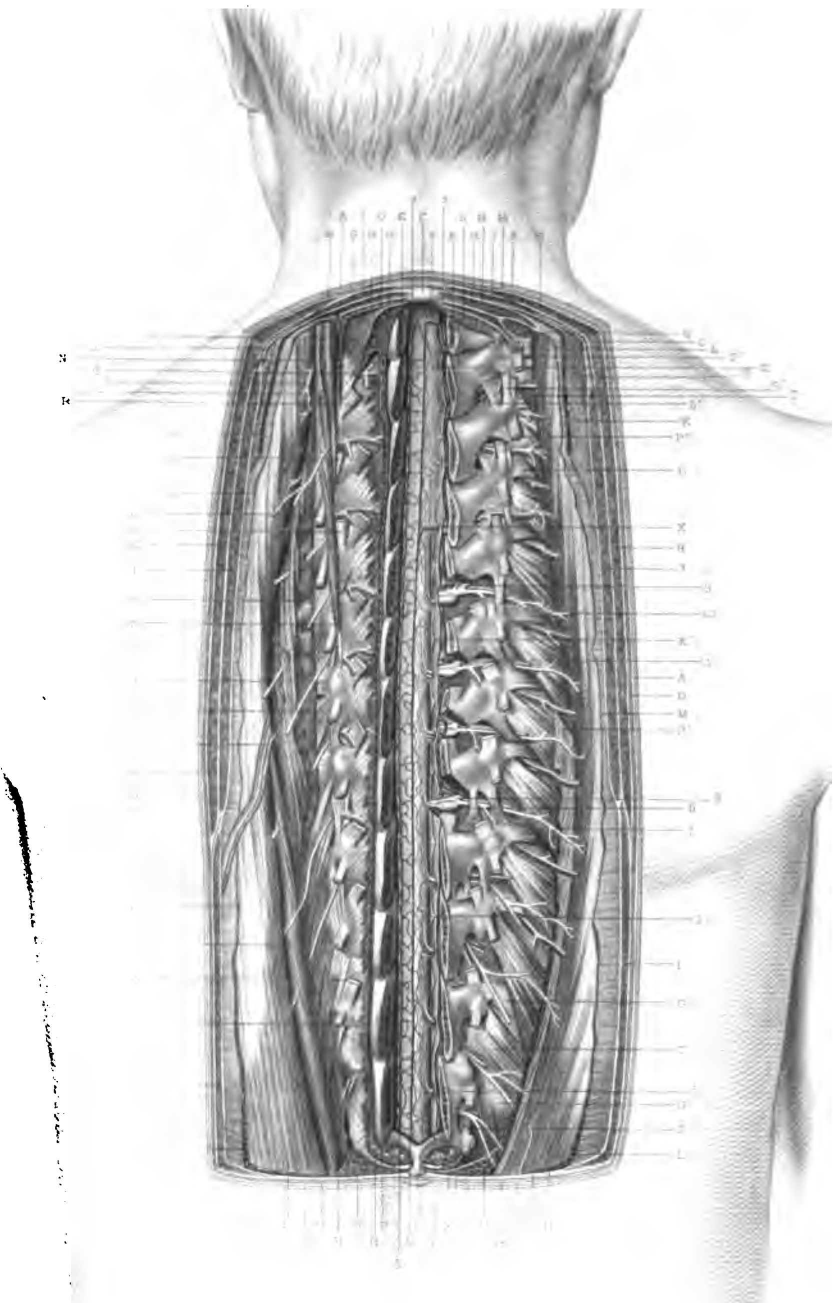
The processes and laminæ of the vertebræ are formed like the keel of a boat, so that if a foreign body falls upon them it is deflected outwards; an arrangement which affords an effectual protection to the spinal cord.

In fractures of the vertebral column affecting the bodies of the vertebræ, or even only the spinous processes, an examination of these processes will enable us to form our diagnosis.

When the body of a vertebra is partially destroyed, the laminæ and the processes are pushed backwards, and then by the approximation of the two vertebræ, the one above, the other below that which is destroyed, these laminæ and processes form a considerable projection beneath the integuments, giving rise to a *curve* or *hump* of variable size. At the commencement we can diagnose the disease, by pressure upon the points of the spinous processes. If the pressure is made suddenly it causes a concussion of the vertebra, which is accompanied by pain if it occurs in a vertebra affected by caries. This forms an excellent means of diagnosis.

Wounds of the part are not dangerous so long as they do not penetrate beyond the superficial layer. In fact, there are no important vessels or nerves to be wounded; but we may always expect a diffuse and painful inflammation. Fatty and fibrous tumours, but rarely cancer, occur in the superficial layer. Spina bifida is occasionally met with

In inflammation of the spinal cord it has been recommended to pass a sponge filled with hot water over the region of the spine in order to diagnose the disease. It having been observed that opposite the seat of the inflammation, the patient experiences an acute pain at the moment of the sponge passing over it. This phenomenon, although not constant is nevertheless deserving of attention; it is explained by the distribution of the nervous filaments from the posterior branches of the spinal nerves, which being powerfully acted upon, communicate to the nervous centre a distinct sensation of pain.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XXXIX.

Dorsal Region.

Deep layer.

EXPLANATION.

LEFT SIDE (*third layer*).

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Spinous process of the 7th cervical vertebra, or vertebra prominens.
D. Spinous process of the 1st lumbar vertebra.
E. Lamina of dorsal vertebra divided.
F. Lamina of 12th dorsal vertebra divided.
G. Section of the trapezius muscle.
H. Section of the latissimus dorsi muscle.
H′. Aponeurotic tendon of this muscle.
I. Section of the rhomboideus muscle.
J. Section of the serratus posticus superior.
K. Section of the serratus posticus inferior.
L. Section of the aponeurosis which unites the two serrati muscles.
M. Section of the splenius muscle.
N. Sacro-lumbalis muscle.
N′. Supplementary fibres of this muscle.
O. External fibres of the longissimus dorsi.
O′. Section of the longissimus dorsi.
O″. Tendon of the longissimus inserted into the posterior tubercles from the 7th cervical vertebra up to the 11th dorsal vertebra.
P. Semispinalis colli muscle.
P′. Insertion of the semispinalis colli or posterior tubercle of the transverse process of the 7th dorsal vertebra.
Q. Section of the complexus muscle.
Q′. Tendinous insertion of the complexus or tubercles of the 4th and 5th dorsal vertebræ.
R. Section of the multifidus spinæ muscle.
R′. Tendons of the superficial layer of the multifidus spinæ.
S. Insertion into the posterior tubercle of the transverse process of the 7th dorsal vertebra of one of the levatores costarum muscles.
T. The costo-transverse ligament.
U. Section of the dura mater of the spinal cord.

1. Branch furnished by one of the intercostal arteries accompanied by two veins.
2. Venous plexus situated on the external surface of the dura-mater.
3. Venous sinus receiving the veins from the external surface of the dura mater.
4. Branch of the transverse cervical vein.
5. Posterior branch of the first dorsal nerve going to the muscles and to the skin.
6. Internal ramification of this nerve.

RIGHT SIDE (*fourth layer*).

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Tubercle of the spinous process of the 7th cervical vertebra.
D. Tubercle of the spinous process of the first dorsal vertebra.
E. Lamina of the 1st dorsal vertebra divided.
F. Lamina of the 12th dorsal vertebra divided.
G. Eleventh rib.
G′. Twelfth rib.
H. Section of the trapezius muscle.
I. Section of the latissimus dorsi muscle.
I′. Section of the aponeurosis of this muscle.
J. Section of the rhomboideus muscle.
K. Section of the serratus posticus superior.
L. Section of the serratus posticus inferior.
M. Section of the aponeurosis uniting the two serrati muscles.
N. Section of the splenius muscle.
O. Sacro-lumbalis muscle.
P. Section of the fibres of the longissimus dorsi
P′. Insertion of the longissimus dorsi into the 7th rib.
P″. The divided tendons of the same muscle inserted into the tubercles of the transverse processes of the 1st lumbar vertebra, and of the 3rd dorsal vertebra. Between these two tendons is seen a series of nine other tendons representing the insertions of the longissimus dorsi muscle.
Q. Section of the semispinalis colli muscle.
R. Section of the complexus muscle.
S. Section of the multifidus spinæ muscle.
S′. Section of the tendon of the multifidus spinæ muscle inserted into the tubercle of the transverse process of the first lumbar vertebra.
S″. Section of a similar tendon inserted into the transverse tubercle of the 3rd dorsal vertebra.
S‴. Section of two tendons of the superficial fibres of the multifidus spinæ. Commencing at the 1st lumbar vertebra there exists up to the 3rd dorsal vertebra a series of similar tendons which represent the insertions of the multifidus spinæ into the transverse tubercles of the whole of the dorsal region.
T. One of the levatores costarum muscles.
T′. The last of the levatores costarum muscles.
U. The costo transverse ligament.
V. The dura mater divided and turned back.
X. The inner layer of the arachnoid.
X′. The inner layer of the arachnoid divided.
X″. Ligamentum dentatum.
Z. The pia mater of the spinal cord with the vessels ramifying upon it.

1. Posterior branch of the 6th intercostal artery. A similar artery is seen in each intercostal space which is distributed to the muscles and skin of the back.
2. Posterior venous sinus of spinal canal.
3. Branch of the transverse cervical vein.

4. Dorsal nerves, first pair.
5. Posterior root of the eleventh dorsal pair.
6. Ganglions situated at the junction of the anterior and posterior roots of the spinal nerves.
7. Posterior branch of the 8th dorsal nerve.
8. Anterior or intercostal branch of the same nerve. The same thing is seen in the thin spaces above.
9. Anterior branch of the ganglion of the 5th pair of dorsal nerves. It is seen to be continuous on the side of the cord with the anterior root
10. Muscular nervous branch.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The deep layer offers for our consideration the bones, and the spinal cord.

The bones are deeply placed and consequently but little exposed to fractures. The articulations of the ribs with the vertebral column are so firm that it is difficult to conceive of their being dislocated. Nevertheless some examples have been mentioned. A. Paré was the first to speak of these dislocations, of which he admits three kinds; upwards, downwards, and inwards. Bultet in the eighteenth century only admits of the possibility of the dislocation inwards occurring in the four or five last true ribs and the two or three first false ribs. Boyer denies any dislocation of this kind, but at the present time six well authenticated cases are known. They have been recorded by Henkel, M. Boudet, and Alcock; two cases have been communicated to the Royal Dublin Society; the sixth is contained in the *Archives Générales de Médecine* (1841, t. xi. p. 99.)

The most important part in relation to pathology is the spinal cord; although protected by the masses of muscles, by the spinous processes, by the laminæ of the vertebræ, and by the elastic ligaments, the spnial cord and its membranes are nevertheless exposed to every kind of injury. Thus it is liable to be wounded or contused. It is true, the imbricated condition of the laminæ of the vertebræ protect it from being wounded by pointed or cutting instruments, but bullets may reach it, it is the same with regard to fractures, which by the projection of fragments produce compression, causing paralysis of the parts to which the nerves are distributed immediately below the point of compression.

We may judge of the effect of this compression by examining the nerves which issue from the spinal cord in the dorsal region; the higher the point of compression the more extended will be the effect of the lesion. Thus injury to the spinal cord at the point of junction between the dorsal and the cervical region will produce, not only paralysis of the lower extremities, but also of the muscles forming the walls of the abdomen, and also of all the intercostal muscles. Only the diaphragm will escape being paralysed, because it receives its motor nerves from the cervical region: it is thus that we can explain the partial continuation of the act of respiration when the spinal cord has been injured high up in the dorsal region.

These wounds of the spinal cord are not fatally incurable. The partial or complete paralysis which characterises them may be cured, as has been shown by the recent observations of M.M. Brown-Séquard and Follin. These writers have proved that a cicatrix is formed between the two extremities, and that subsequently nervous fibres are formed which re-establish the communication between the two portions.

The almost vertical direction of the surfaces by which the articular processes are connected together, renders the production of a dislocation forwards extremely difficult. It is, in fact, necessary that the inferior processes should become placed in front of the processes of the vertebra above, involving a previous separation which is almost impossible without fracture. Displacement forwards is therefore necessarily preceded by fracture of the articular processes, or of other parts of the vertebra. Dislocation backwards is not prevented by the articular processes, but they must be extremely rare in consequence of the numerous connexions which unite the different elements of the vertebræ together. After violent shocks we sometimes find disturbance of the nervous system manifesting itself in the organs which receive their nerves from the dorsal portion of the spinal cord; in these cases it is then said that there has been concussion of the spinal cord; in our opinion this concussion is scarcely possible in consequence of the structure of the cord and the facility with which the effects of shocks are dispersed through the multiplicity of pieces forming the spine. We attribute these disturbances to the stretching of the nerves which emanate from the spinal cord. In fact at the time of the accident, the cord is displaced *en masse* in the surrounding fluid; secured by the attachments of the ligamentum dentatum, and by the nerves, it cannot receive any great shock, nor can it approximate sufficiently near to its osseous case so as to receive a concussion, but by its displacement it stretches the nerves. This stretching may make itself felt: 1. At the points of implantation of the anterior and posterior roots, and where the fibres are very delicate; 2. At the points where the nerves correspond to the foraminæ of conjugation.

The only operations which have been performed upon the spinal cord are the extraction of foreign bodies, and trephining. The foreign bodies which have required extraction are pointed, cutting, or blunt instuments. The cases of M. Velpeau and of M. Hard are too well known to render it necessary to repeat them here. It is the same with regard to those recorded by Cuvillers and Louis. Trephining of the spinal cord was first performed by Cline, then by Tyrrel in 1822, and by M. Laugier in France in 1840. A fourth case belonged to Mr. Potter. This operation has not as yet been adopted in general practice. It might be indicated in a case of fracture of the spine with depression of a portion of the bone or in hæmorrhage occupying the cavity of the spine. M. Brown-Séquard has published a memoir to prove the utility of the operation.

PLANCHE XL.

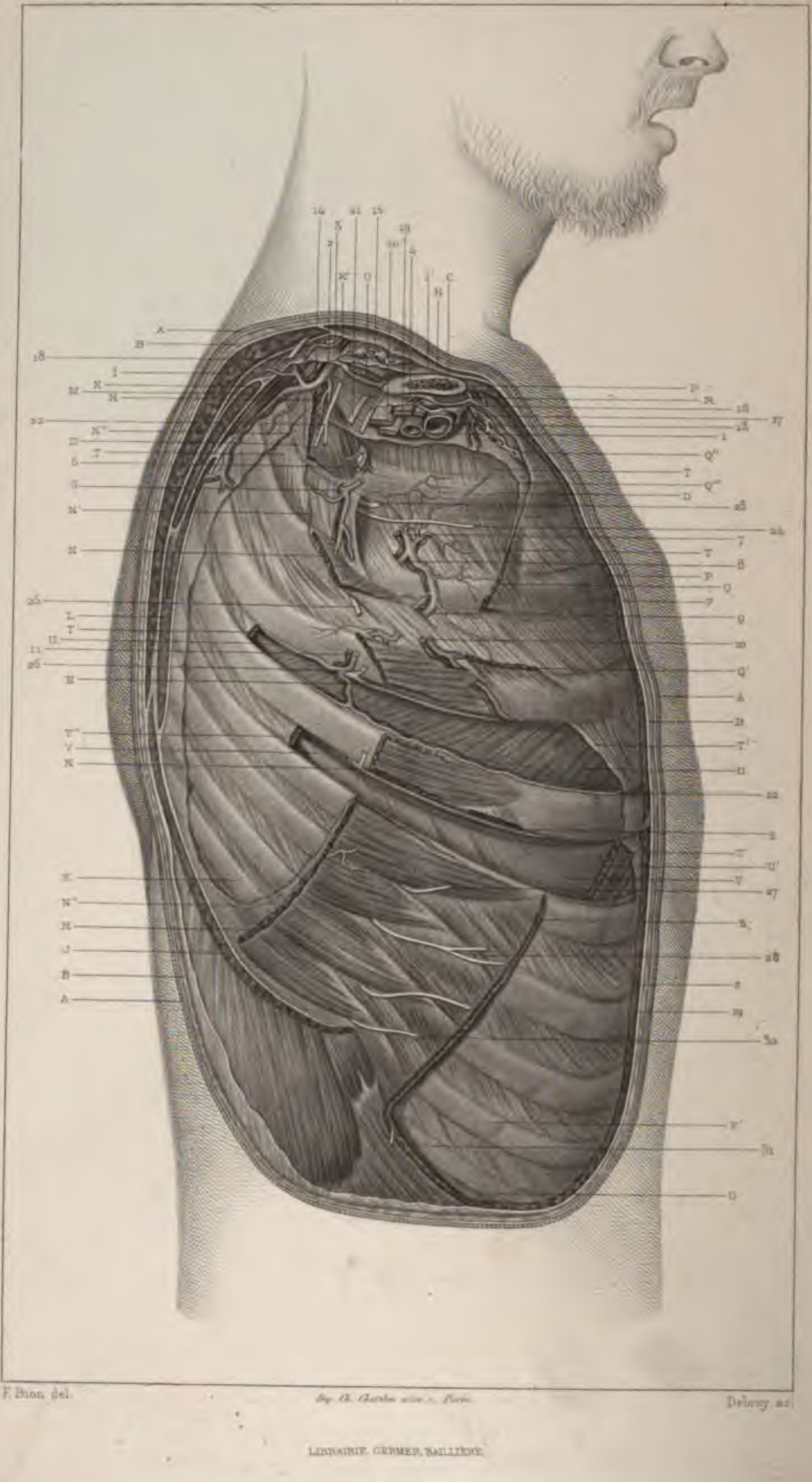

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PLATE XL.

Figure 1. — Costal Region.

EXPLANATION.

A. Section of the skin bounding the region.
B. Subcutaneous fascia.
C. Section of the clavicle.
D. Second rib.
E. Ninth rib.
F. Articulation of the third rib with its corresponding costal cartilage.
F′. Articulation of the ninth rib with its corresponding costal cartilage.
G. Costal cartilage of the tenth rib.
H. Section of the platysma myoides muscle.
I. Section of the trapezius muscle.
J. Section of the latissimus dorsi muscle.
K. Section of the levator anguli scapulæ muscle.
K′. The cervical aponeurosis continuous posteriorly with the aponeurosis of the levator anguli scapulæ, and becoming double anteriorly to invest the omo-hyoideus muscle.
L. Section of the rhomboideus muscle.
M. Posterior scalenus muscle.
N. Section of the serratus magnus muscle.
N′. Section of the aponeurosis uniting the two superior sets of fibres of the serratus magnus muscle.
N″. Section of the aponeurosis which separates the serratus magnus from the ribs.
O. Section of the omo-hyoideus muscle.
P. Section of the pectoralis major muscle.
Q. Section of the pectoralis minor muscle.
Q′. Section of the inferior fibres of the pectoralis minor.
Q″. Section of the superficial layer of the aponeurosis of the pectoralis minor, becoming united with the subclavian aponeurosis.
Q‴. Section of the aponeurosis situated beneath the pectoralis minor, passing to assist in forming above the sheath of the vessels and nerves of the arm.
R. Section of the subclavian muscle enclosed in its aponeurotic sheath.
S. Section of the external oblique muscle of the abdomen.
T. External intercostal muscles.
T′. Section of the external intercostal muscles of the fourth and fifth intercostal spaces.
T″. Section of the external and internal intercostal muscles of the fifth intercostal space.
U. Internal intercostal muscle of the fourth intercostal space.
V. The pleura seen opposite the fifth intercostal space.

1. Section of the axillary artery.
2. Transverse cervical or posterior scapular artery.
3. Subscapular artery.
4. Acromial artery.
5. Superficial or perforating branch of the first intercostal.
6. Superficial or perforating branch of the second intercostal space.
7. Section of the external thoracic artery.
8. Branch of the artery going to anastomise with the artery of the second intercostal space.
9. Anastomosis of the external thoracic artery with the artery of the third intercostal space.
10. Section of one of the terminal branches of the external thoracic artery.
11. Section of another terminal branch of the external thoracic anastomosing with the intercostal artery of the fourth intercostal space.
12. Termination of the artery of the fourth intercostal space.
13. Section of the axillary vein.
14. Transverse cervical vein.
15. The lymphatic glands and vessels of the subclavian triangle.
16. The subclavian lymphatic glands.
17. Sub-pectoral lymphatic glands and vessels.
18. Nervous branch to the trapezius.
19. The two superficial trunks of the brachial plexus.
20. The two deep trunks of the same plexus.
21. Subscapular nerve.
22. Nerve distributed to the serratus magnus.
23, 24. Branches of the nerve of the second intercostal space.
25. Perforating branch of the nerve of the third intercostal space.
26 Perforating branch of the nerve of the fourth intercostal space.
27. Perforating branch of the nerve of the sixth intercostal space.
28. Perforating branch of the nerve of the seventh intercostal space.
29. Perforating branch of the nerve of the eighth intercostal space.
30. Perforating branch of the nerve of the ninth intercostal space
31. Perforating branch of the nerve of the tenth intercostal space.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The costal region is frequently the seat of various and serious deformities. We know, for instance, that the use of stays in women, gives rise to projections and depressions which are sometimes very considerable. In rickets or osteomalacia it may be pressed inwards or project outwards. It is the same in cases of softening of the bones in old age, a subject which has recently been brought before the *Société de Biologie* by MM. Charcot and Vulpian. When the vertebral column inclines to the right or to the left, the costal region becomes bent in on the side towards which the curvature is directed, the ribs approximate and the intercostal spaces are narrowed, while, on the contrary, on the opposite side the costal region is bowed out, the ribs separate from each other, and the intercostal spaces are enlarged.

In persons who have been cured of effusion into the thorax accompanied with adhesions, the costal parietes are depressed inwardly by a process which is readily understood. When the inspiratory muscles dilate the chest, the points to which the pleura is adherent do not partake of the dilitation, and hence there is a depression which is still further increased by retraction of the tissues forming the cicatrix.

The superior ribs are seldom fractured, because they are protected by the shoulder and the masses of muscle placed in front and behind; and the inferior because they are extremely moveable. The middle ribs are the most exposed to this accident because they are more superficial and less protected.

J. L. Petit propounded a theory of the mode in which these fractures occur that has long prevailed, but which M. Malgaigne has refuted by arguments drawn from the simple observation of facts. According to J. L. Petit the rib represents an arch whose central portion may be driven inwards by a violent blow causing a direct or inward fracture. J. L. Petit further admitted that the pressure acting on the two extremities of the arch and tending to bring them together would cause a fracture of the central portion towards the exterior, and hence give rise to an outward or indirect fracture. This theory is only correct within certain limits. Thus, says M. Malgaigne, a blow acting on the middle of a rib frequently only produces a single direct fracture, but sometimes it also produces an indirect fracture at some distance from the first. Nor must it be supposed that the fracture always commences on the inner table of the bone, sometimes it begins on the external table and is confined to it alone. With regard to indirect fractures they do not occur at the middle part of the rib, but are situated more anteriorly; from 2 to 7 millemetres (·078 to ·265 English inch) external to the costal cartilages, and when the pressure acts on the spine they are situated close to the neck of the rib. In simple fracture the displacement is not great. The action of the muscles have been called into account for this displacement, but M. Malgaigne has reduced to its true value the action of the intercostal muscles, of the latissimus dorsi, and of the pectoralis major and minor muscles. In fractures of the ribs as in all others, says M. Malgaigne, either the periosteum has not been torn, and the fractured portions remain in contact without the action of the muscles having any effect; or if the periosteum is destroyed the muscles are also lacerated, and one end of the bone, either jagged or bevelled off, is depressed below the other, and the inequalities of the fractured surfaces form an impediment to complete reduction. If the obliquity of the fracture is directed from the superior to the inferior margin of the rib, one portion forms a slight projection above, and the other below, arising from the same cause. Lastly, when the fracture is double and the central portion has been driven inwards towards the cavity of the chest, the action of the intercostal muscles and the expansion of the chest in inspiration can only restore it very imperfectly to the level of the other portions.

The free movements of the costal region form a constant obstacle to the retention of the fractured portions of the ribs in position, and hence part of the treatment consists in diminishing these movements. This is accomplished by placing a bandage around the chest, compelling it to be dilated by the movements of the diaphragm.

Fractures of the costal cartilages are very rare; they are characterised by the fracture being always smooth and perpendicular to the axis of the cartilage. Generally the sternal portion overlaps in front of the other. All the preparations of these cases show that the fractures become united by a ring of bone.

Since 1837, however, M. Malgaigne has shown that in young persons the union is formed by cartilaginous tissue; sometimes also a joint is formed at the seat of fracture.

The union of the costal cartilages with the ribs is not very strong, and hence the facility with which they may be dislocated. These dislocations are reduced and reproduced with equal facility, they are accompanied with a cracking sound and sometimes with pain. Apart from this circumstance, these dislocations are not very serious, and it is unnecessary to attempt a complete reduction which moreover is not always possible.

Wounds of the costal region when confined to the superficial layer are generally harmless. At the upper part, however, they may be accompanied with severe hæmorrhage in consequence of their implicating the thoracic arteries. When the wound is deep it may involve the ribs and the intercostal arteries. Wounds of the intercostal arteries have long engaged the attention of surgeons and various plans have been suggested for arresting the hæmorrhage which ensues. The apparatus of Quesnay and that of Lottery, both of which act on the principal of a lever, making use of the inferior rib as the point of resistance, are ingenious suggestions, but often unsuccessful. Plugging the wound is preferable, either by means of a pledget of lint fixed externally by a ligature, or after the plan of Dupuytren who employed a compress which was wedged into the wound and into the cavity of which small masses of lint were inserted.

The arrangement of the muscular layers and the relations of the intercostal muscles explain why pus, originating from caries of the bodies of the vertebræ, makes its way along the course of the intercostal vessels and nerves, and passing in between the internal and external intercostal muscles presents beneath the integument on the sides of the chest, precisely where the vessels and nerves issue which are distributed to the skin.

One very important operation is performed in the costal region, we refer to paracentesis of the pleura. This operation is indicated whenever asphyxia arises in consequence of serous effusion, or from the discharge of pus or blood into the pleura. Sometimes the proper place for performing the operation is indicated by a projection, but generally speaking the surgeon will have to choose where it shall be done. His anatomical knowledge will then be of great service to him.

The spot selected as the most convenient, says M. Malgaigne should fulfil three conditions: 1. It should place the opening sufficiently low; 2. It should avoid the diaphragm; 3. It must avoid the intercostal artery. The latter condition is easily fulfilled. From the articulation of the rib with the vertebræ as far as its angle and even somewhat beyond it, the artery traverses the intercostal space obliquely from below upwards so as to gain the groove of the superior rib, along which it passes for about the length of eight centimetres (3·150 English inch). Beyond that it emerges from the groove and divides into two branches which are too small to give rise to a hæmorrhage of any consequence. Altogether one is certain of avoiding the artery by dividing the intercostal space from the angle of the ribs by a line placed midway between the sternum and the vertebræ. It is generally agreed that the point selected should correspond to the junction of the posterior third of the chest with the anterior two thirds.

In order to avoid wounding the diaphragm we should never operate below the tenth rib. In France it is recommended to pass the instrument between the tenth and ninth rib on the left side, and between the ninth and eighth on the right side.

In order to find the third or fourth intercostal space, counting from below upwards, it is recommended to count the ribs from below upwards if the patient is thin. If the patient is fat or œdematous, the point for the incision or perforation may be selected at six fingers breadth below the inferior angle of the scapula, or the hand of the patient may be placed upon the sternum, and the operation performed on a level with the elbow drawn a little backwards. These are very uncertain guides, and M. Malgaigne very properly recommends that the last rib which is connected with the sternum should be taken as a starting point, or the last intercostal space which reaches to this bone, that being the sixth. In fat persons or where there is infiltration, the inferior margin of the thorax can always be felt, and the incision may be made without any fear three fingers breadth above it.

Paracentesis of the pleura is no longer performed by means of the actual cautery or by caustics, incision or puncturing only is employed. This is simple, easily performed and always enables us to reach the intercostal space; but it is not so with the trochar, the point of the instrument being liable to strike against the rib. In order to avoid this serious inconvenience, we recommend the following method of proceeding: the index finger is placed on the region in a direction parallel to the ribs, with it we depress the soft parts, and thus satisfy ourselves whether it is opposite one of the ribs, or an intercostal space; if it is opposite the intercostal space the depression is greater and we make our puncture at that part.

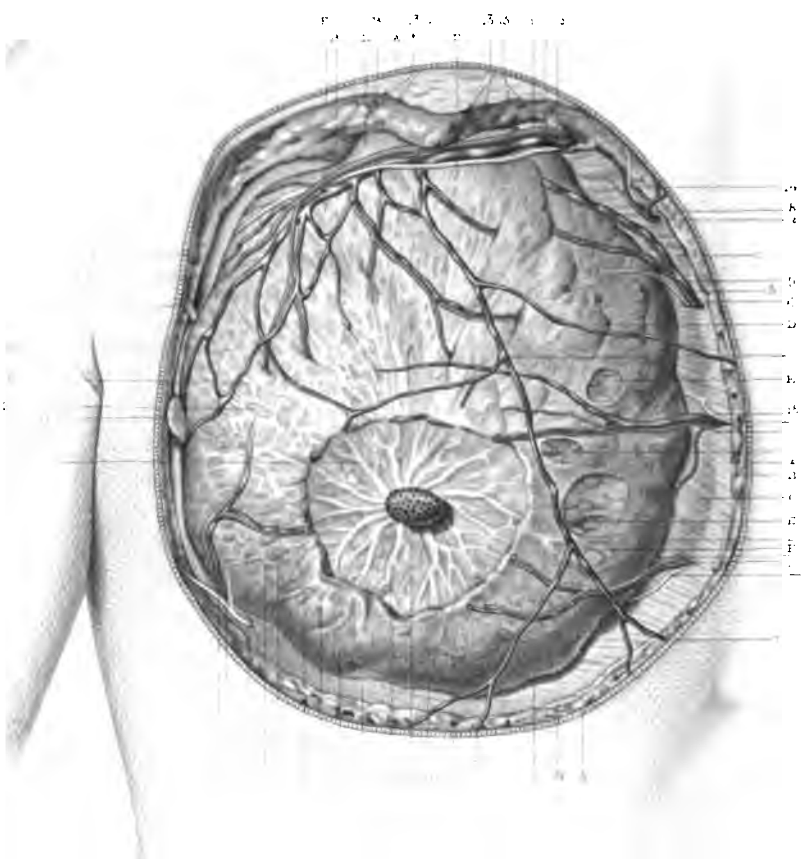

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PLATE XLI.

Mammary Region.

(*Female died after confinement*).

EXPLANATION.

A. Section of the skin bounding the region.
B. Fatty subcutaneous fascia.
B′. Deep layer of the superficial fascia passing behind the mammary gland.
C. Aponeurosis covering the pectoral muscle.
D. Lobes of the mammary gland.
E. Lobules of the gland more deeply seated (the cavities at the bottom of which these lobules are seen were filled with fat. The margins of these cavities are free).
F. Superficial lactiferous ducts.
G. Deep lactiferous ducts terminating in the nipple.
H. The nipple with its orifices.
I. Section of a layer of the mammary gland to show the lactiferous ducts.

1. First branch given off by the internal mammary artery, much developed.
2. Second branch of the internal mammary artery.
3. Third branch of the internal mammary artery.
4. Fourth branch of the internal mammary artery.
5. Fifth branch of the internal mammary artery.
6. Branch furnished by the external mammary artery.
7. Vein accompanying the first arterial branch and receiving nearly all the veins that are beneath the subcutaneous fascia in front of the mamma as well as the veins which emerge from the gland.
8. Second vein only slightly developed.
9. Third vein arising within the gland.
10. Fourth vein whose origin is at the base of the nipple.
11. Fifth vein having the same commencement as the preceding.
12. Vein accompanying a branch of the intercostal.
13. Branches of nerves from the cervical plexus.
14. Nervous branch furnished by the intercostal nerves.
15. Nervous branch from the second intercostal nerve, it anastomoses with the accessory nerve of the internal cutaneous nerve of the arm.
16. Branch of the third intercostal nerve.
17. Branch of the fourth intercostal nerve ramifying in the gland.
18. Branch from the fifth intercostal nerve passing beneath the gland.
19. Branch from the sixth intercostal nerve.
20. A branch which has passed through the pectoralis major muscle to reach the skin.
21. Lymphatic gland receiving the lymphatic vessels of the mamma.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In consequence of the menstrual discharge, and especially of the important function of lactation, the breast is liable to various diseases, more particularly to inflammatory affections and to tumours which commence in the different tissues of which it is composed.

The nipple may be more or less projecting. In primiparæ, it is generally still imperfectly developed and hence arise difficulties in suckling. As it is composed of irregular projections, the skin is very fine between the prominences, thus accounting for the facility with which liquids, powders, and the remains of organic matter become lodged, producing cracks, fissures and ulcerations that are frequently obstinate and always very painful.

In his work entitled "*Traité sur les maladies du sein et de la région mammaire*," M. Velpeau, taking the different layers and their anatomical elements as a basis, has established the following subdivisions of its inflammations and suppurations: 1. Superficial or subcutaneous inflammation; 2. Deep or submammary inflammation; 3. Glandular or parenchymatous inflammation In each of the layers the inflammation may commence in any one of the constituent tissues, whence there arises as many separate diseases, each having their special and distinctive characters

Inflammation of the subcutaneous layer is not unfrequent, but it seldom takes a diffuse form. Yet there are few surgeons who have not witnessed cases of diffuse inflammation of the breast, we have seen some that we treated successfully by means of extensive and numerous incisions.

M. Richet has remarked that these phlegmonous inflammations do not attack the areola and the nipple because there is no lax cellular tissue beneath them.

Behind the breast there is a serous cellular tissue which is very liable to become inflamed and to suppurate. In some instances we have ascertained the existence of a true serous sac. These inflammations and suppurations may be primary or consecutive. When they exist, the breast is raised up and projects anteriorly as if it was separated from the costal surface. The abscess then shows itself towards the circumference of the mammary region and towards its lower part where it is most delicate and where it is most convenient to open them. A large opening has enabled us to obtain a cure of several of these abscesses. In these cases the fluctuation is always slow to show itself, and is difficult to determine, it must therefore be sought for at the most dependent part.

Parenchymatous inflammation and suppuration are sometimes situated in the interlobular cellular tissue, sometimes in the acini of the gland, and sometimes in the lactiferous tubes. In the latter case the inflammation has received the name of *hair (poil)* or of *galactocèle*. When the inflammation is in the lobes it gives rise to numerous abscesses which recur at intervals in the neighbouring lobes: hence arises those interminable series of abscesses which attack some women after their confinement, and which have been so well described by M. Velpeau.

M. Nélaton has pointed out that one of the most frequent causes of these disorders is inflammation of the lymphatic vessels. The lymphatic vessels traversing the breast accompany the lactiferous ducts, and mark the course taken by the inflammation which is localised sometimes in one tissue, sometimes in another.

It is not uncommon to meet with inflammation of the breast in the new born child. These abscesses are remarkable for speedily closing up when they have been opened with a bistouri. In several cases which occurred at the Maternity Hospital we obtained a rapid cure after the evacuation of the pus.

There are few organs more liable to tumours of all kinds than the breast. We meet with hypertrophy, simple engorgement, cysts, gelatinous, *(gommeuse)* fibrous and fibro-plastic tumours, cancers, &c. M. Richet, MM. Maisonneuve and Yvarèse have each of them met with syphilitic tumours of the breast analagous to a similar kind of tumour affecting the testicle.

Cancer has a predilection for this gland. It commences most frequently in the nipple which is then sure to diminish in length and even to disappear, being drawn inwards by a kind of shrinking up of its cellular tissue and its lactiferous ducts. In cancer of the breast the glands of the axilla become enlarged, and it is the same as regards the intercostal lymphatic glands and those which accompany the internal mammary artery. This circumstance explains the occurrence of the severe sub-sternal pains of which women complain who are attacked with cancer of the breast.

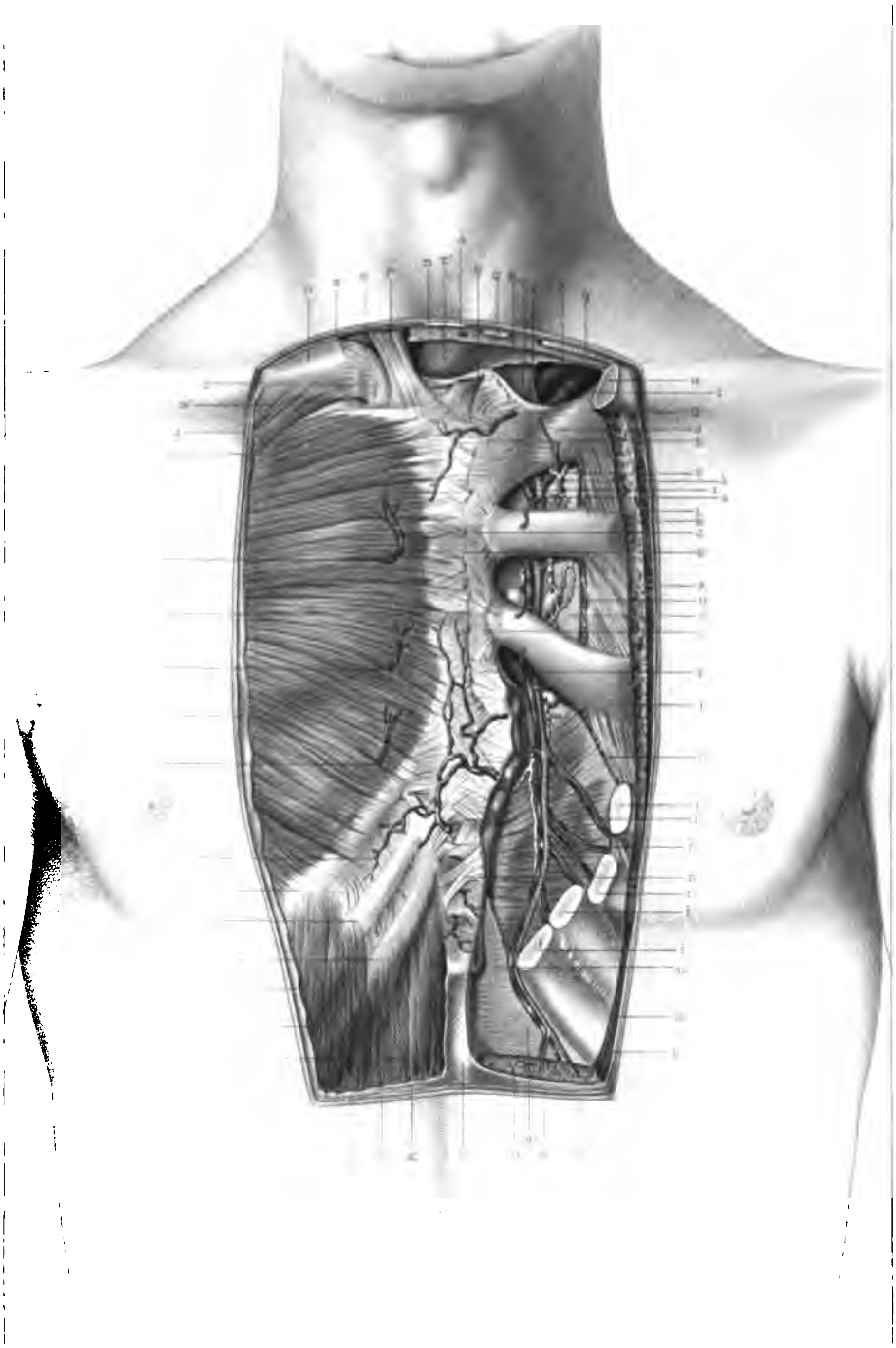
In the advanced stages of cancer of the breast the pectoral muscles are sometimes involved and the disease may even extend to the pleuræ. A good method, and one we are able to confirm, has been pointed out by M. Michon of judging of the deep adhesions of cancer of the breast. Whenever the skin is affected by the cancer and becomes adherent, we may be sure that the pectoralis major is also involved and united to the tumour.

When the cancer has reached the axilla and given rise to large glandular masses of cancer, we must not risk the chances of an operation which cannot effect a cure. If the glands are only slightly enlarged the operation should be performed, and we have occasionally even seen the glands diminish and resume their normal size after the removal of the tumour from the breast.

The operations performed upon the breast are incisions, extirpation and cauterisation. Incisions for the discharge of pus should always be made as far as possible from the areola and the nipple, in order to avoid opening the dilitations or ampullæ of the lactiferous ducts situated beneath them, and so giving rise to milk sinuses which are often very difficult to cure.

Complete or partial removal of the breast is usually a simple operation, but it is sometimes followed by accidents such as hæmorrhage or erisepelas. It is sufficient to examine the source of the vessels as represented in the Plate to account for this hæmorrhage; it comes more especially from the long thoracic artery and from the branches of the internal mammary. . These vessels must therefore be carefully ligatured. The veins which traverse the surface of the tumours are sometimes very large and even varicose, but when the contained blood has escaped they speedily collapse so that the hæmorrhage is arrested spontaneously.

The large number of lymphatic vessels situated in the skin of the breast readily explains the facility with which erisepelas shows itself after these operations. Possibly cauterisation is less liable to be followed by it, and explains the success obtained by M. Girouard of Chartres and of M. Maissoneuve from the employment of caustic points.



LIBRAIRIE GERMER BAILLIÈRE

PLATE XLII.

Region of the Sternum.

EXPLANATION.

RIGHT SIDE.

Superficial layer.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
B′. Section of the platysma myoides muscle.
C. Cartilages of the 5th 6th and 7th ribs.
D. Ligament of the sterno-clavicular articulation.
E. Muscular fibres (not named).
F. Sternal tendon of the sterno-cleido-mastoideus muscle.
G. Clavicular portion of the sterno-cleido mastoideus muscle.
H. Pectoralis major muscle.
H′. Fibres of the pectoralis major muscle passing to be inserted into the anterior margin of the clavicle.
I. Section of the aponeurosis of the pectoralis major muscle.
J. Superior extremity of the rectus abdominis muscle.
K. Section of the aponeurosis of the rectus.

1. Arterial and venous ramifications furnished by the mammary vessels and distributed to the integument.
2. Pre-sternal plexus furnishing the vessels which pass into the substance of the sternum.

LEFT SIDE.

Deep layer.

A. Section of the skin.
B. Section of the superficial fascia.
C. Section of the platysma myoides muscle.
D. Section of the aponeurosis which unites the two platysma muscles in the median line.
E. Anterior surface of the sternum (first piece).
F. Second piece of the sternum covered by ligamentous fibres.
G. Ziphoid appendix.
G′. Ligamentous fibres covering the ziphoid appendix.
H. Section of the clavicle.
I. Section of the cartilages of the 4th, 5th, 6th, and 7th ribs.
I′. Articulation between the cartilage and the rib.
J. Articulation between the sternum and the cartilages of the 1st, 2nd and 3rd ribs.
K. Section of the fibres of the pectoralis major muscle.
K′. Section of the ligamentous fibres of the pectoralis major.
L. Section of the aponeurosis of the pectoralis major.
M. Section of the rectus abdominis muscle.
M′. Longitudinal fibres of the rectus abdominis passing to be inserted into the sixth costal cartilage.
N. Section of the aponeurosis of the rectus abdominis.
N′. Linea alba.
N″. Aponeurosis forming the posterior wall of the sheath of the rectus abdominis.
O. Sections of the anterior and posterior intercostal muscles between the 1st, 2nd, 3rd and 4th ribs.
P. External surface of the triangular muscle of the sternum.
Q. Section of the sternal tendon of the sterno-cleido-mastoideus muscle.
Q′. Section of the clavicular tendon of the sterno-cleido-mastoideus muscle.
R. Section of adipose matter placed between the layers of the cervical aponeurosis.
S. Anterior surface of the sterno-hyoideus muscle.
T. Section of the aponeurosis of the sterno-hyoideus muscle.
T′. Anterior surface of the second aponeurotic layer covering the sterno-hyoid muscles.
U. External surface of the costal pleura.

1. Internal mammary artery.
2. Internal mammary vein.
3. Subclavian vein.
4. Section of the anterior jugular vein.
5. Lymphatic glands of the first intercostal space.
6. Lymphatic glands accompanying the internal mammary artery.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In the median line the skin is but slightly moveable or extensible, we should therefore be very careful how we cause any loss of its substance at this part; according to M. Velpeau this is the reason that wounds involving loss of substance take so long and are so difficult to heal; the depression which occurs in cicatrices at this part is to be attributed to the same cause.

The sternum is composed of three pieces, which for a long time remain distinct, these are: the manubrium, the gladiolus and the appendix. The two first pieces are sometimes situated on a different plane, especially in workmen who rest their tools against the front of the chest, giving rise to a deformity which might be mistaken for a dislocation. The two articulations which unite the three pieces composing the sternum may be the seat of dislocations. A dislocation between the first and second piece is very rare. Duvernoy was the first to observe it, at present, thanks to the memoir of M. Maissoneuve we are acquainted with ten of these cases. Dislocation of the ziphoid appendix, is still more rare; mentioned by A. Paré and Codronchi it has been seen twice since. It is by no means proved that all the disturbances experienced by some patients in the neighbourhood of the stomach or of the heart, and attributed to this dislocation, were really caused by it.

The sterno-clavicular articulation situated in this region is liable to various displacements upwards, backwards and forwards. The presence of the first rib renders a dislocation downwards impossible; in the dislocation forwards, which may be either complete or partial, the head of the clavicle is always covered by the skin; in the dislocation backwards the head of the clavicle is driven beneath the sternum, behind the sterno hyoid and sterno-thyroid muscles. We can readily understand that in consequence of this new position of the head of the clavicle, such a displacement, especially if it is complete, may give rise to symptoms of compression, in regard to the vessels, to respiration and to deglutition. In the dislocation upwards, the internal extremity of the clavicle rests between the sterno-cleido-mastoideus anteriorly, and the sterno-hyoideus posteriorly. The three situations occupied by the dislocated head are therefore separated from each other by muscles so as to render any mistake impossible.

Projecting beneath the skin, the sternum is liable to be fractured, but the frequency of these fractures is diminished by its mobility and especially by its elasticity. These fractures may give rise to serious accidents in consequence of the fractured portions pressing upon the organs situated within the thorax.

Like all the subcutaneous vascular spongy bones, the sternum is frequently liable to osteitis, caries, necrosis, and the formation of tumours. When suppuration occurs on the superficial surface, the pus makes its way beneath the skin which it speedily destroys and ulcerates; caries is easily recognised from the appearance of the wound, or if that is insufficient by means of the probe. Nevertheless in some cases, the pus spreads along the ribs and so reaches the axilla. I have under my care at this time a lady fifty years of age in whom the pus first made its appearance above in the median line opposite to the caries; it then took an outward direction and passed beneath the mamma where it formed a considerable tumour near the external margin of the pectoralis major. This tumour also presented a projection on the right side of the sternum below and internal to the mamma; I made a small opening at this part which gave issue to a quantity of offensive pus.

When the suppuration occurs on the deep surface of the sternum, the pus makes its ways into the anterior mediastinum, and shows itself either in the intercartilaginous spaces, or lower down near the epigastrium.

Extensive necrosis will sometimes produce a large opening into the chest without involving loss of life, as in the case observed by Harvey, where the pulsations of the heart could be seen through the part which had been destroyed. This circumstance should encourage the surgeon to remove the sequestræ produced by these necroses.

In many cases it has been recommended to trephine the sternum. M. Drivon entertained the idea of trephining this bone for the purpose of tying the brachio-cephalic artery. Hitherto this operation has only been performed on the dead body.

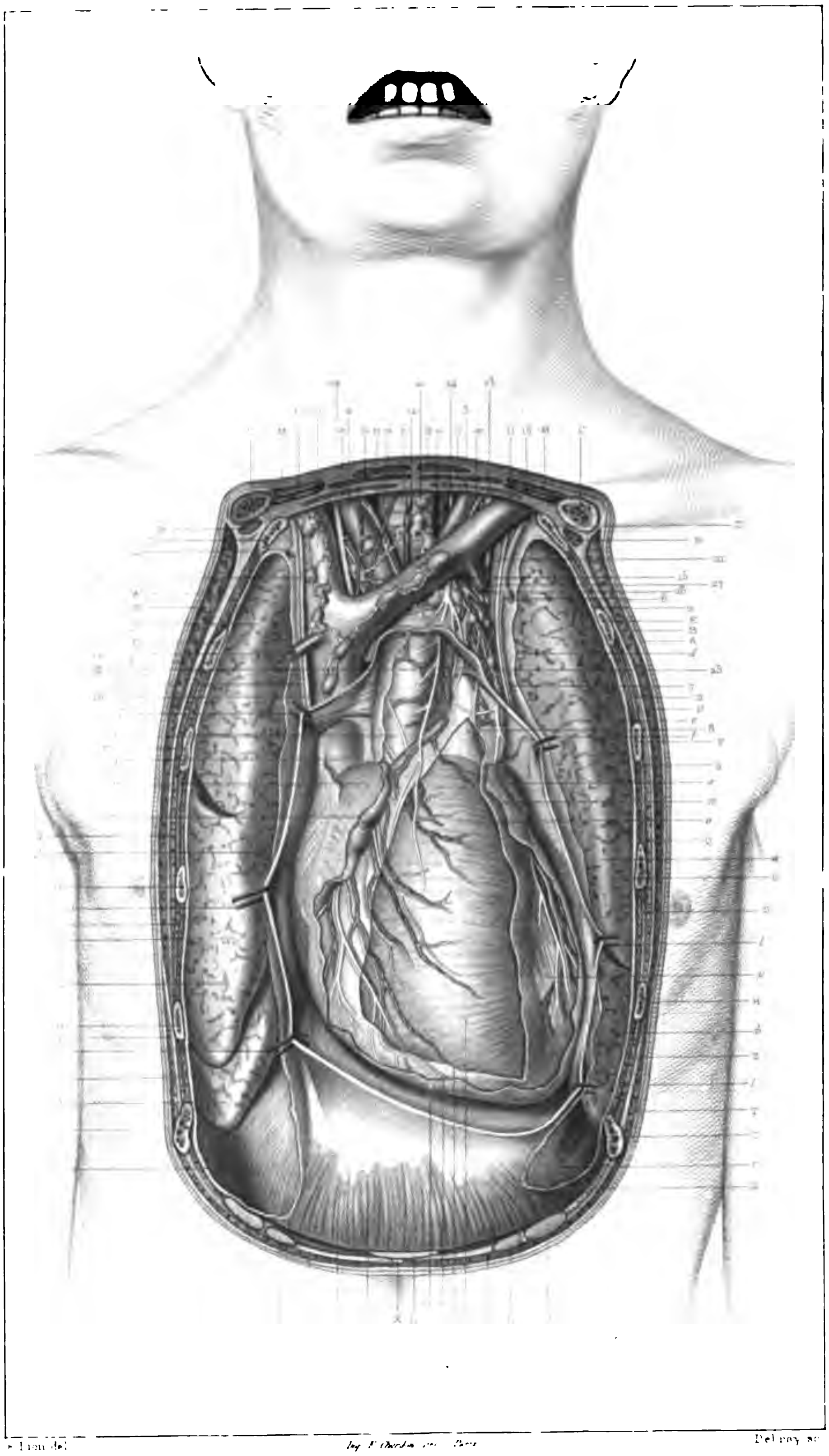
In paracentecis of the pericardium, Skiedelrup and Laennec have proposed to perforate the sternum towards its lower third on the left side, there is, however, a more easy method of reaching the pericardium and therefore this proceeding has not been adopted.

Lamartinière and J. L. Petit have recommended perforating the sternum for the purpose of opening abscesses in the mediastinum; this operation has been attended with good results.

We may reach the pericardium from two other points, 1. Between the ziphoid appendage and the cartilage of the seventh rib; 2. Through one of the intercostal spaces. Larrey recommended the first method; a bistouri is to be passed from below upwards avoiding at the same time the pleura, the peritoneum, the diaphragm and the internal mammary artery. We do not think this proceeding is as free from danger as the one we are about to describe.

The pericardium may be reached through several of the intercostal spaces, but opinions are greatly divided as to which is the most convenient. Desault made an incision between the sixth and seventh ribs. Larrey penetrated between the fifth and sixth. Schuh selected the space between the third and fourth ribs close to the left edge of the sternum. Heger has perforated the space between the fifth and sixth ribs, five centimetres and a half (2·165 English inch) from the edge of the sternum. M. Behier penetrated between the seventh and eighth ribs, in the course of a vertical line passing to the external margin of the mamma, and, not having succeeded, he passed the instrument between the sixth and seventh ribs, immediately beneath the breast, lastly, M. Jobert (de Lamballe), in conjunction with M. Trousseau chose the third intercostal space, at a distance of three centimetres (·881 English inch) from the sternum preceding the puncture by an incision reaching down to the muscles. It is also at this part that M. Aran operated. The latter space is the one which it appears to us should be preferred.

The internal mammary artery may be wounded in operating, or by injuries inflicted accidentally with cutting instruments; superiorly it is of sufficient size to give rise to severe hæmorrhage. Should such an accident happen, the artery must be freely exposed and both ends tied, for its numerous anastamoses may easily reproduce hæmorrhage if only the superior extremity is secured. When two ligatures cannot be applied, the vessel must be tied above the point where the instrument has penetrated. To do this, an incision must be made from three to four centimetres (1·081 to 1·574 English inch) in length parallel to the edge of the sternum; about one centimetre (·393 English inch) external to this edge we divide successively the skin, the subcutaneous cellular tissue, the superficial aponeurosis of the pectoralis major, the fibres of this muscle and of the intercostal muscles, beneath the deep apponeurosis of which the vessel makes its appearance. It must be separated from the accompanying vein or veins by one of Deschamps or Sir Astley Cooper's needles. This ligature is rarely employed.



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LIBRAIRIE GERMER BAILLIERE

PLATE XLIII.

Region of the Mediastinum.

Anterior Mediastinum.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the clavicle.
D. Section of the 1st rib.
E. Section of the 2nd rib.
F. Section of the 3rd rib.
G. Section of the 4th rib.
H. Section of the 5th rib.
I. Articular surface of the 6th rib.
J. Section of the 7th costal cartilage.
K. Section of the 8th costal cartilage.
L. Section of the ziphoid appendix.
M. Section of the sterno-cleido-mastoideus muscle.
N. Section of the sterno-hyoideus muscle.
O. Section of the sterno-thyroideus muscle.
P. Section of the pectoralis major muscle.
Q. Section of the pectoralis minor muscle.
R. Section of the subclavius muscle.
S. Section of the internal and external intercostal muscles.
T. Section of the rectus abdominis muscle.
U. Section of the triangular muscle of the sternum.
V. Muscle of the diaphragm.
X. Linea alba of the abdomen.
a. Superior lobe of the left lung.
b. Inferior lobe of the left lung.
c. Cavity of the left pleura.
d. Section of the left pleura bounding the anterior mediastinum turned outwards.
e. Section of the parietal layer of the left pleura.
f. Superior lobe of the right lung.
g. Middle lobe of the right lung.
h. Inferior lobe of the right lung.
i. Cavity of the right pleura.
j. Section of the right pleura bounding the anterior mediastinum, turned outwards.
k. Section of the right parietal pleura.
l. The pericardium held open with hooks (the whole of the anterior part of the sac has been cut away).
m. Cavity of the pericardium serous surface.
n. Section of the serous membrane of the heart and of the visceral layer of the pericardium.
o. Section of the fibrous membrane of the heart.
p. Fibres situated in the inter-ventricular grove and inserted into the fibrous membrane of the heart
q. Muscular fibres of the heart covering the right ventricle.
r. Right auricle.
s. Left auricle.
t. The trachea.
u. The œsophagus.
v. Section of the anterior deep layer of the cervical aponeurosis.
x. Section of the thymus gland.
1. Commencement of the arch of the aorta.
2. Trunk of the brachio-cephalic artery.
3. Left common carotid artery.
4. Right internal mammary artery divided.
5. Right phrenic artery.
6. Section of the left internal mammary artery.
7. Left phrenic artery.
8. Origin of the pulmonary artery.
9. The superior vena cava.
10 Right brachio-cephalic venous trunk.
11. Left brachio-cephalic venous trunk.
12. Section of the right internal mammary vein.
13. Section of the left internal mammary vein.
14. Inferior middle thyroid vein.
15. Small venous trunk receiving the right phrenic vein and the aortic venus plexus.
16, 17. Transverse veins situated behind the sterno-mastoid muscle.
18. Aortic venous plexus forming a communication between the veins of the heart and the left brachio-cephalic vein.
19. Lymphatic glands receiving the internal mammary lymphatics, the lymphatics of the right side of the pericardium and of the lung, and furnishing lymphatic vessels which empty themselves into the great lymphatic vein.
20. Lymphatic glands receiving the lymphatics from the left side of the pericardium and other lymphatics which come from the right side of the upper part of the chest.
21. Deep lymphatic glands.
22. Right pneumogastric nerve giving after a course of 6 to 7 millemetres (·236 to ·345 English inch) in length the recurrent nerve which passes beneath the right brachio-cephalic artery.
23. Left pneumogastric nerve.
24 Left recurrent nerve.
25. Left phrenic nerve coming from the cervical plexus
26. Right phrenic nerve.
27.• Nerve coming from the pneumogastric and forming with the branch of the sympathetic that accompanies the brachio-cephalic artery, the anterior aortic plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds of this region may extend to organs most essential to life, and may therefore produce extreme danger. It is sufficient to notice the heart and the vessels which pass from it and enter into it to form an adequate idea of this danger. It is, in fact, difficult to conceive that any weapon or projectile can pass through the sternum without at the same time wounding the arteries and veins which are above the mediastinum, or the heart which is below it. These wounds are mostly fatal from the profuse hæmorrhage they give rise to. An instrument passing directly from before backwards can only reach the mediastinum after it has traversed the region of the sternum, unless it should be on the left side and low down; for at this part the mediastinum comes in connection with the costal region, and it is this region which must be previously traversed. The relations of the different organs and their order of super-position show that below, a wound, which was not very deep, might only involve the pericardium, or with it the right cavities of the heart and the pulmonary artery. A deeper wound, passing in the same direction would necessarily reach the left cavities of the heart and the aorta at its commencement. If the wound occurred at the highest part of the mediastinum, the arch of the aorta might be wounded independently of the pulmonary artery, for at this height the relative position of the two vessels is entirely changed, so that the aorta has become anterior to the pulmonary artery. The thickness of the walls of the ventricles enables us to understand the possibility of their being wounded without the cavities being penetrated. An example of this is mentioned in the case of a soldier in whom a bullet was lodged in the parietes of the right ventricle for a period of six years.

The left cavities of the heart and several organs situated low down in the mediastinum may be injured if the instrument or projectile impinges upon the chest in an oblique direction. Some writers have mentioned injury of the œsophagus in its thoracic portion, but it is readily perceived that such a lesion must be very rare. Blondin saw a young man who in a duel had the azygos vein divided by a bullet near its terminal curve; the projectile had passed through the mediastinum from its inferior to its posterior part and had become lodged in the bodies of the dorsal vertebræ.

Abscesses may occur in the anterior mediastinum. These abscesses are either idiopathic or symptomatic. The occurrence of the first is readily explained by the presence of the large amount of cellular tissue which forms as it were, a bed for the lodgment of the numerous vessels and of the various organs situated in the region. The second may arise from caries of the sternum, of the ribs, of the costal cartilages, or from suppuration after inflammation of one of the numerous articulations belonging to the region. Abscesses from congestion in the cervical region make their way into the posterior mediastinum. The disposition of the fasciæ of the neck readily explain this peculiarity. The numerous superficial lymphatic glands belonging to the anterior mediastinum also occasionally give rise to the formation of pus, especially in tuberculous affections of the chest These abscesses may open in the region of the sternum by passing between the intercartilaginous spaces, but most frequently they reach the more dependent parts, passing in front of the pericardium and spreading into the abdominal parietes as far as the pit of the stomach by traversing the opening of the diaphragm below the ziphoid cartilage.

Lymphatic glands are seen situated high up in the mediastinum and following the course of the superior vena cava, and of the two brachio-cephalic venous trunks Hypertrophy, cancer and every kind of alteration in these glands produces compression of these veins since the glands can only extend in the direction of the more deeply seated parts being restrained anteriorly by the resisting surface of the sternum. This compression has the effect of producing a serous infiltration of the upper extremities, face, head, and neck. The ascending portion of the aorta is sometimes the seat of aneurism. Anatomy teaches us the course these tumours will take. It is evident that the aneurismal sac can easily reach the posterior surface of the sternum and of the costal cartilages, and that while aneurisms of the descending aorta will affect the vertebral column, those of the ascending and transverse portions will cause absorption of the anterior boundaries of the thorax. It is in consequence of this that these aneurisms in an advanced stage show themselves through the sternum dislocating the sterno-clavicular or chondro-costal articulations. The relations of the transverse portion of the aorta with the trachea explain why these aneurisms compress the air tube and produce disturbance of the respiration. It also explains why the lungs, the pulmonary veins, the brachio-cephalic and the superior vena cava become pressed upon, and hence the deep seated and various disturbances which show themselves in these diseases

The brachio-cephalic artery belongs to the superior and right portion of the anterior mediastinum. It is therefore the occasion on which to discuss the propriety of ligaturing this artery. There is no doubt the artery may become obliterated without the circulation of the head, the neck or of the right upper extremity being for a moment interrupted; the numerous anastamoses of the carotid and cervical arteries in the median line are quite sufficient to maintain the circulation, but the effects attending the spontaneous obliteration of the artery cannot be compared with those caused by the application of a ligature. During the process of spontaneous obliteration the patient runs no risk of hæmorrhage while there are numerous risks of this in the application of a ligature It is almost impossible but that frightful hæmorrhage should occur when the ligature comes away as the brachio-cephalic trunk is very short so that the ligature can only be applied a few millemetres (0·0393 English inch) beyond its bifurcation, the clot which is formed in the vessel next the heart will be very small, and there is the greatest probability that it will be driven out by the column of blood coming from the heart. In thirteen cases of this operation there has been thirteen deaths. These numbers require no comments. Is it, however, to be said that the unfortunate persons who have aneurism at the commencement of the subclavian, of the right carotid, or of the brachio-cephalic artery are beyond the resources of surgery? We think not. Wardrop and Sir A. Cooper have obtained remarkable success by tying aneurismal arteries between the tumour and the capillaries. M. Broca lately acted in this way in a case of aneurism of the brachio-cephalic artery only tying the subclavian artery and obtained a marked improvement in the condition of the patient.

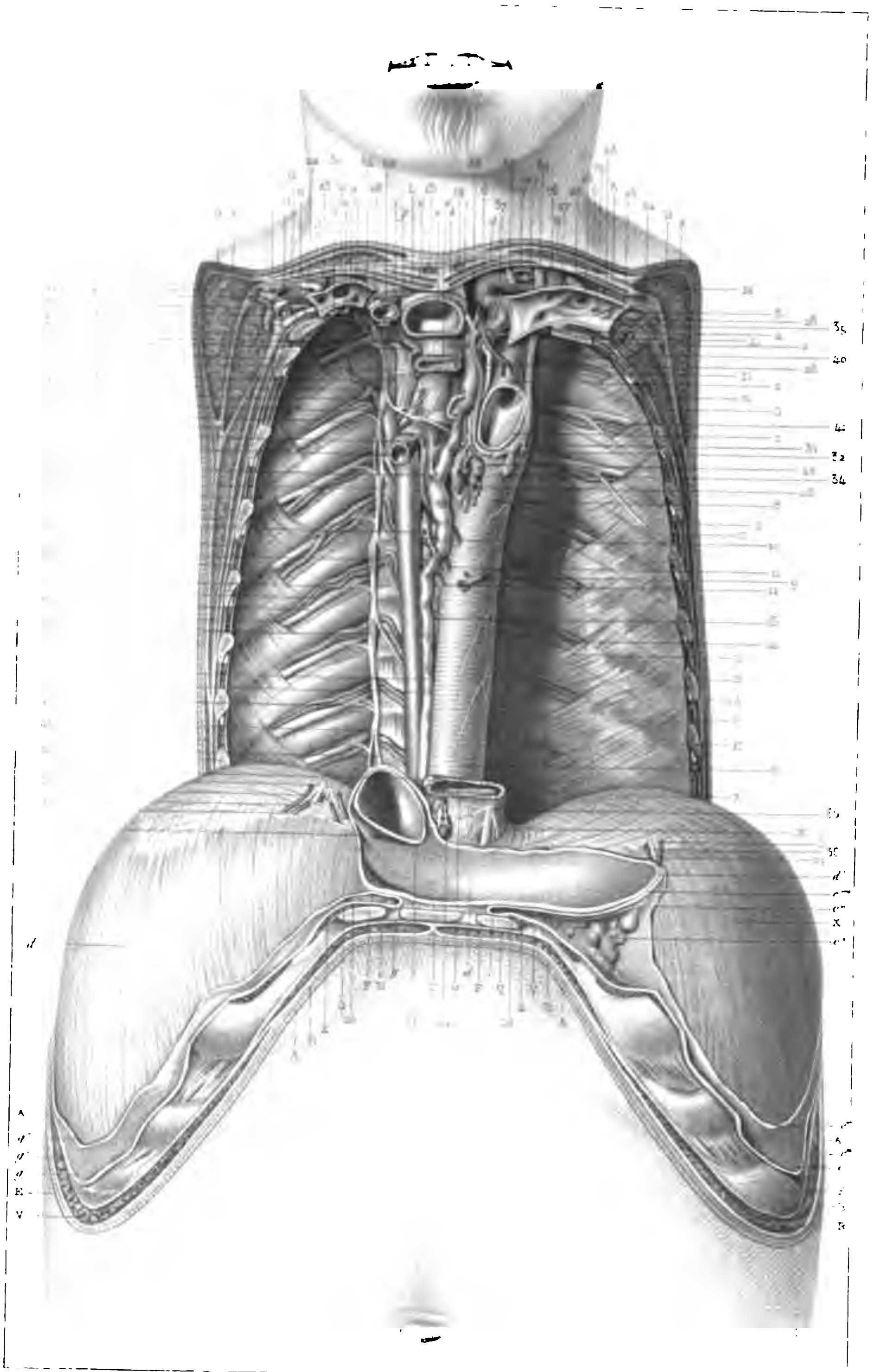

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PLATE XLIV.

Region of the Thorax.

Posterior Mediastinum.

EXPLANATION.

RIGHT SIDE.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Section of the ziphoid appendix.
D. Section of the second rib.
E. Section of the eighth rib.
E′. Superior margin of the ninth rib.
F. Section of the eighth costal cartilage.
G. Inter-vertebral disc separating the bodies of the second and third dorsal vertebræ.
H. Ligamentous fibres situated between the superior margin of the fourth rib and the inferior margin of the transverse process of the third dorsal vertebra.
I. Section of the platysma myoides muscle.
J. Section of the sterno-cleido-mastoideus muscle.
K. Section of the sterno-hyoideus muscle.
L. Section of the sterno-thyroideus muscle.
M. Section of the omo-hyoideus muscle.
N. Section of the anterior scalenus muscle.
O. Section of the posterior scalenus muscle.
P. Section of the trapezius muscle.
Q. Section of the omo-hyoideus muscle.
R. Section of the rhomboideus muscle.
S. Section of the serratus posticus superior muscle.
T. Section of the latissimus dorsi muscle.
U. Section of the rectus abdominis muscle.
V. Section of the obliquus externus muscle.
X. Inferior extremity of the longus colli muscle.
Z. Section of the triangular muscle of the sternum.
a. Section of the fourth external intercostal muscle.
b. Section of the fourth internal intercostal muscle.
c Subcostal muscle (muscular fibres passing inside the ribs from one internal intercostal to the neighbouring one.)
c′. Arch formed by the first fibres of the subcostal muscle beneath which the vessels and nerves pass.
d. Muscular fibres of the diaphragm.
d′. Aponeurotic centre of the diaphragm traversed by the vessels and nerves of the diaphragm.
e. Section of the trachea.
f. Section of the right thymus gland.
g. Cavity of the pleura.
g′. Section of the costal pleura.
g″. Section of the pleura covering the diaphragm.
h. Section of the pericardium.

1. Section of the brachio-cephalic artery.
2. Section of the subclavian artery.
3. Section of the subcapular artery.
4. Section of the internal mammary artery.
5. Superior intercostal artery.
6. Superior phrenic artery.
7. Section of the right bronchial artery.
8. Artery of the sixth intercostal artery.
9. Section of the subclavian vein.
10. Orifice of the internal jugular vein.
11. Section of the external jugular.
12. Section of the transverse cervical vein.
13. Section of the anterior jugular vein.
14. Section of the azygos vein.
15. Azygos vein.
16. Vein of the sixth intercostal space.
17. Superior intercostal vein terminating in the azygos vein.
18. Trunk receiving the veins of the first and second intercostal spaces and a large trunk emerging through the foramen of conjugation.
19. Superior phrenic veins.
20. Internal mammary vein.
21. Inferior vena cava situated in the pericardium.
22. Great lymphatic vein.
23. Its opening into the right subclavian vein.
24. Thoracic duct.
25. Lymphatic glands and vessels around the vertebræ emptying themselves into the thoracic duct.
26. Lymphatic vessels passing to the thoracic duct.
27. Section of one of the glands placed between the œsophagus and the trachea.
28. Section of the pneumogastric nerve.
29. Section of the recurrent nerve.
30. Section of the phrenic nerve.
31. Section of the brachial plexus of nerves situated above the axillary artery.
32. Section of the brachial plexus of nerves situated below the same artery.
33. Sixth intercostal nerve.
34. First ganglion of the sympathetic.
35. Nervous branch furnished by the second ganglion of the sympathetic which assists in forming the pulmonary, aortic, and cardiac plexuses.
36. Third ganglion of the sympathetic.
37. Fourth ganglion of the sympathetic.
38. Fifth ganglion of the sympathetic.
39. Sixth ganglion of the sympathetic.
40. Seventh ganglion of the sympathetic.
41. Great splanchnic nerve.
42. Anastamosis of the sympathetic with the seventh intercostal nerve. (A similar arrangement is seen with regard to the other intercostal nerves.)

LEFT SIDE.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the ziphoid appendix.
D. Section of the second rib.
E. Section of the eighth rib.
E′. Cartilage of the same rib.
F. Section of the cartilage of the sixth rib.
G. Section of the platysma myoides muscle.
H. Section of the sterno-cleido-mastoideus muscle.
I. Section of the sterno-hyoideus muscle.
J. Section of the sterno-thyroideus muscle.
K. Section of the omo-hyoideus muscle.
L. Section of the posterior scalenus muscle.
M. Section of the trapezius muscle.
N. Levator scapulæ.
O. Section of the rhomboideus and superior serratus muscle.
P. Section of the latissimus dorsi muscle.
Q. Section of the rectus abdominis muscle.
R. Section of the oblique muscle of the abdomen.
S. Section of the external intercostal muscle of the fourth space.
T. Section of the internal intercostal muscle of the same space.
U. Subcostal muscles.
V. Section of the triangular muscle of the sternum.
X. Muscular fibres of the diaphragm.
X′. Muscular fibres of the diaphragm forming the œsophageal ring.
X″. Central or cordiform tendon of diaphragm.
a. Section of the œsophagus.
b. Section of the remains of the thymus gland.
c. Cavity of the pleura.
c′. Fatty appendages of the pleura.
c″. Section of the diaphragmatic pleura.
c‴. Section of the costal pleura.
c⁗. Section of the pericardial pleura.
d. Cavity of the pericardium.
d′. Section of the wall of the pericardium.
e. Section of the trachea.

1. Section of the arch of the aorta.
2. Subclavian artery.
2′. Section of the subclavian artery.
3. Section of the transverse cervical artery.
4. Section of the internal mammary artery.
5. Section of the superior phrenic artery.
6. Superior œsophageal artery.
7. Section of the common carotid.
8. Origin of the thoracic aorta.
9. Œsophageal and mediastinal artery.
10. Third intercostal artery giving a branch to the right bronchus.
11. Artery of the fourth right intercostal space.
12. Artery of the fifth right intercostal space.
13. Artery of the tenth right intercostal space.
14. Artery of the seventh left intercostal space.
15. Section of the parietes of the left subclavian vein.
16. Internal jugular vein.
17. Termination of the internal jugular vein in the brachio-cephalic trunk.
18. Termination of the external jugular in the subclavian vein.
19. Anterior jugular vein.
20. Internal mammary vein.
21. Left superior phrenic vein.
22. Lymphatic glands situated beneath the trapezius.
23. Another lymphatic gland divided, situated behind the subclavian vein.
24. Glands and lymphatic vessels situated on the anterior surface of the œsophagus before traversing the diaphragm.
25. Bronchial lymphatic glands.
26. Lymphatic vessels from these glands emptying themselves into the thoracic duct.
27. Termination of the thoracic canal.
28. First opening of the thoracic canal into the subclavian vein.
29. Second opening of the thoracic canal.
30. Left pneumogastric nerve.
31. Branch of the pneumogastric going to the lung.
32. Another branch of the pneumogastric furnishing the recurrent laryngeal and branches to the cardiac and pulmonary plexuses.
33. Left recurrent nerve.
34. Section of the left pneumogastric nerve in the thorax.
35. Section of the pneumogastric nerve accompanying the œsophagus.
36. Section of the phrenic nerve.
37. Branch coming from the great sympathetic and anastomosing with the recurrent laryngeal.
38. Branch of the sympathetic going to the cardiac plexus.
39. Trunk of the brachial plexus in front of the axillary artery.
40. Trunk of the brachial plexus behind the axillary artery.
41. Intercostal nerve of the third space.
42. Aortic plexus of the sympathetic.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

If wounds of the anterior mediastinum are dangerous, those of the posterior mediastinum are still more so. The latter involve not only the vessels but also the nerves as well as the trachea and the œsophagus. Fortunately all these organs are deeply situated and thus escape being wounded by cutting instruments. It is unnecessary to say that wounds of the œsophagus are dangerous in consequence of the food escaping into the cellular tissue of the mediastinum, and from the inflammation which necessarily follows. Wounds of the descending aorta give rise to a hæmorrhage which is speedily fatal. These wounds are more frequent at the upper than the lower part of the region, because in the latter situation the point of the instrument has to pass from before backwards through the whole of the fleshy mass of the heart and of the layers of the pericardium.

Abscesses of the posterior mediastinum like those of the anterior are either idiopathic or symptomatic. The first occur in the cellular tissue surrounding the trachea, the œsophagus or the aorta. Symptomatic abscesses may depend upon alterations in one of the organs situated in this region or it may originate at a distance. Thus the lymphatic glands which are so numerous, suppurating under the influence of a scrofulous or a tuberculous diathesis, the discharge of purulent matter from the pleura, from inflammation of the bones, from caries or necrosis of the bodies of the vertebræ or from the posterior extremity of the ribs may give rise to an abscess in the mediastinum. Pus may also accumulate there when it has originated in the neck and even at the base of the cranium, following the direction of the anterior surface of the vertebral column. From whatever cause they arise, abscesses of the posterior mediastinum may spread into the abdominal cavity by passing through the openings in the diaphragm for the nerves, vessels and œsophagus. These abscesses may then show themselves in the rectum or the perineum. Very rarely they pass into the anterior mediastinum and reach the sternal region.

Aneurisms situated in the second portion of the arch of the aorta and in the descending aorta which is continuous with it are directed backwards, they compress the trachea and the œsophagus obliterating their canals, and may make their way into their interior. Those which arise in the concavity of the arch of the aorta press upon the root of the left lung while those which come from the convexity are developed in the direction of the cervical region and project above the interclavicular notch of the sternum. Allan Burns was therefore right in saying that these aneurisms might be mistaken for aneurisms of the carotids or of the brachio-cephalic artery and of the branches which come off from it. Any one who should suggest a good means of diagnosis in these cases would confer a benefit upon surgery. We might perhaps obtain such a diagnosis by compressing the carotids.

The plate shows the intimate manner in which the recurrent nerve is connected with the arch of the aorta and with the commencement of the descending aorta, a condition which explains why this nerve soon becomes pressed upon by aneurisms belonging to these vessels. This circumstance accounts for the loss of voice which occurs almost from the commencement of these aneurisms. The recurrent nerve on the left side is evidently more liable to be pressed upon than that on the right side, because aneurism of the aorta is more frequent than of the brachio-cephalic artery which serves as the surface of reflexion to the right recurrent nerve. Aneurisms of the descending aorta, at first compress the œsophagus, but being fixed to the vertebral column they afterwards push the heart forwards so as to produce the idea of there being disease of that organ. In this case the mistake is the more easily made, in consequence of the patient feeling the double beat of the heart more distinctly and more anteriorly than usual. Aneurisms of the thoracic aorta injure and destroy the bodies of the vertebræ especially on the left side, and here as in all other parts of the body the bones yield more readily than the fibro-cartilaginous tissues. Blandin mentions an instance where a person had an aneurism of the descending aorta so large, that the tumour, after having occupied the left pulmonary cavity, pushed aside the corresponding lung, destroyed the posterior extremities of the ribs, and extended into the dorsal region where its pulsations could be felt.

Very numerous and very complex, the organs of the posterior mediastinum are liable to tumours of all kinds, tubercular, fibrous, lepomatous or cancerous, and we can understand that all these formations may speedily cause disorganisation in their vicinity; thus compression of the trachea, the œsophagus, the vena azygos, and of the thoracic canal, is almost inevitable. Nevertheless the mobility of the organs enables them up to a certain point to escape these injurious effects. Even the sympathetic nerve becomes pressed upon. As soon, says M. Richet, as the aneurismal sac begins to be developed it has a tendency to press upon this nervous trunk and the presence of the tumour, in consequence of the depth at which it is placed, is only rendered evident by the disturbance that occurs in the organs receiving their nerves from this portion of the sympathetic. These disturbances are of so singular a nature that it would be quite impossible, except from previous experience, to refer them to the presence of this disease. M. Richet mentions a very remarkable case, seen by him in conjunction with M.M. Bouillard and Trousseau, where these disorders served as a guide to the diagnosis of the disease. When one of the pleuræ is filled with fluid, the mediastinum is pushed towards the opposite side to that in which the fluid is collected, and in this way the heart may be transferred to the superior part of the right thoracic cavity. When the fluid has been evacuated the heart will almost return to its proper position, as well as all the other organs which had accompanied it in its displacement.

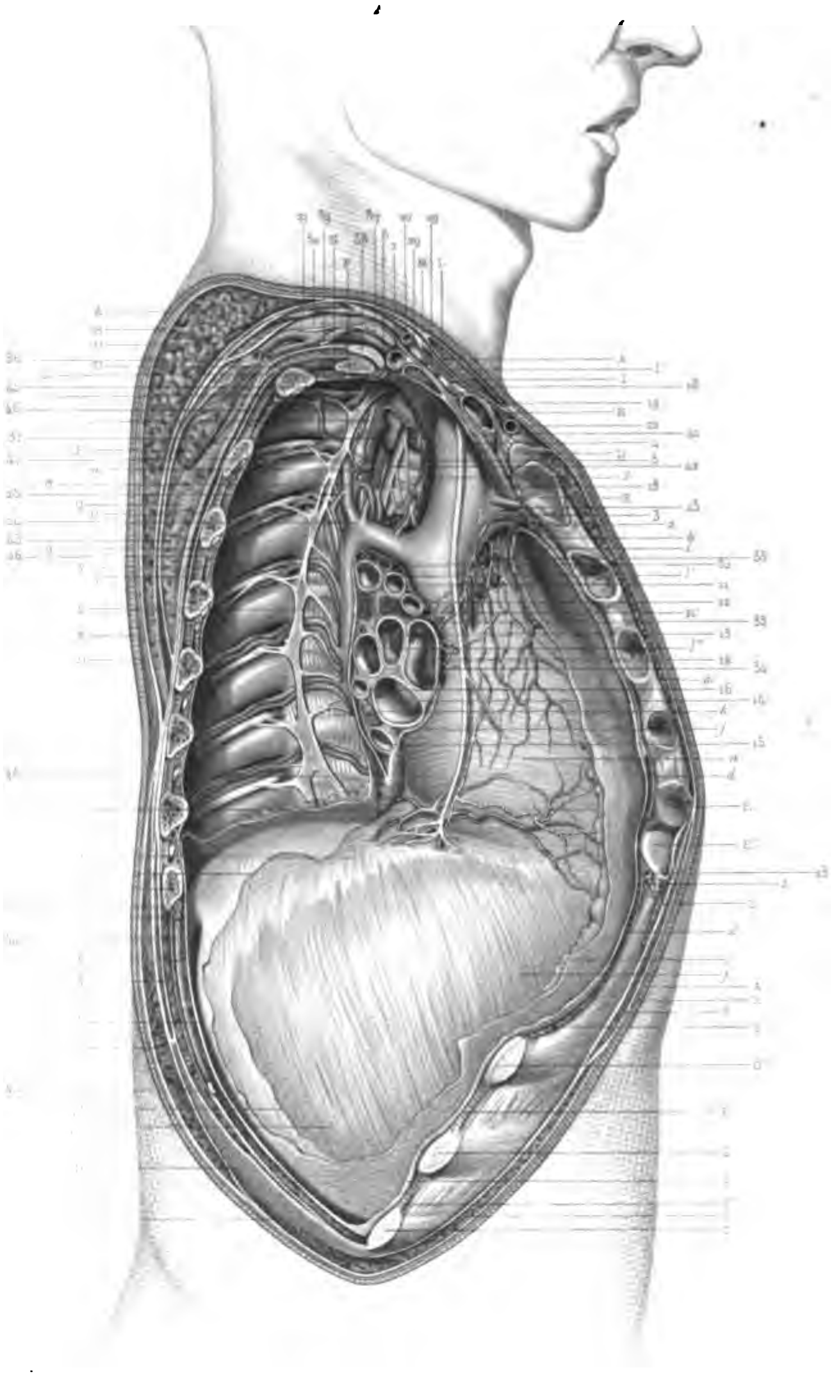

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PLATE XLV.

Region of the Thorax.

Right Cavity of the Chest.

EXPLANATION.

A. Section of the skin.
B. Section of the superficial fascia.
C. Vertebral column.
D. Articular surface of the sternum.
E. Articular surface of the sternum for the first costal cartilage.
E′. Articular surface of the sternum for the fifth costal cartilage.
E″. Articular surface of the sternum for the sixth costal cartilage.
F. Section of the first rib.
G. Section of the ninth rib.
G′. Surface of cartilage articulating with ninth rib.
G″. Articular surface of the eighth costal cartilage.
G‴. Articular surface of the seventh costal cartilage.
H. Superior edge of the tenth rib.
I. Section of the platysma myoides muscle.
J. Section of the sterno-cleido-mastoideus muscle.
K. External edge of the sterno-thyroideus muscle.
L. Section of the omo-hyoideus muscle.
M. Section of the scalenus anticus muscle.
N. Section of the scalenus posticus muscle.
O. Section of the trapezius muscle.
P. Section of the levator scapulæ muscle.
Q. Section of the rhomboideus muscle.
R. Section of the serratus posticus superior muscle.
S. Section of the serratus posticus inferior muscle.
T. Section of the latissimus dorsi muscle.
U. Section of the external intercostal muscle of the first intercostal space.
V. Section of the external intercostal muscle of the second intercostal space.
V′. Section of the internal intercostal and subcostal muscles of the fourth intercostal space.
X. Section of the external intercostal muscle of the ninth intercostal space.
X′. Section of the internal intercostal muscle of the ninth intercostal space.
Z. Intercostal muscles in the sixth intercartilaginous space.
Z′. Section of the intercostal muscles in the seventh intercartilaginous space.
Z″. Section of the intercostal muscles in the eighth intercartilaginous space.
Z‴. Section of the intercostal muscles in the ninth intercartilaginous space.
a. Section of the pectoralis major muscle.
b. Section of the right rectus abdominis muscle.
c. Section of the obliquus abdominis muscle.
c′. Insertion of the obliquus abdominis muscle into the tenth rib.
d. Section of the triangularis sterni muscle.
e. Longus colli muscle.
f. The diaphragm.
g. Central or cordiform tendon of the diaphragm.
h. Section of the costal pleura.
i. Section of the pericardial pleura.
i′. Section of the pleura of the diaphragm.
i″. Section of the pleura covering the tendinous centre of the diaphragm.
j. Section of the pleura covering the centre of the lung.
k. Section of the pulmonary tissue in the pedicle of the lung.
l. The trachea.
l′. Section of the right bronchus going to the superior lobe of the lung.
m. Muscular fibres of the œsophagus.
n. Pericardium.

1. Section of the subclavian artery.
2. Section of the internal mammary artery.
3. Superior phrenic artery.
4. Branch of the internal mammary artery going to the diaphragm.
5. Bronchial artery coming from the superior intercostal.
6. Section of the transverse cervical artery.
7. Superior intercostal artery.
8. First intercostal artery arising from the above and giving off the right bronchial artery.
9. Section of the fourth intercostal artery.
10. Section of the ninth intercostal artery.
11. Section of one of the branches of the eighth pulmonary artery.
12. Section of the second branch of the right pulmonary artery.
13. Section of the third branch of the right pulmonary artery.
14. Section of the superior branch of the right pulmonary vein.
14′. Section of the inferior branch of the right pulmonary vein.
15. Section of a pulmonary vein.
16. Ramifications of the pulmonary veins.
17. Inferior vena cava entering the pericardium.
18. Division of the vena cava superior.
19. Section of the right brachio-cephalic vein.
20. Section of the external jugular vein.
21. Transverse cervical vein.
22. Section of a venous trunk situated on the upper edge of the sternum, receiving the inferior thyroid veins.
23. Section of the internal mammary vein.
24. Azygos vein.
25. Venous trunk passing into the azygos vein and receiving the œsophageal veins of the first, second and third, intercostal spaces and a large vein emerging through the foramen of conjugation coming from the sinus of the spinal cord.
26. Section of the vein of the fourth intercostal space.
27. Section of the vein of the ninth intercostal space.
28. Lymphatic vein.
29. Lymphatic glands situated beneath the omo-hyoideus muscle.
30. Section of the fatty tissue and the lymphatic glands in the subclavian triangular space.
31. Lympathic glands situated between the œsophagus and the trachea.
32. Section of a lymphatic gland situated in the pedicle of the lung.
33 Section of a lymphatic gland situated on the anterior surface of the pedicle of the lung.
34. Lymphatic gland following the preceding.
35. Lymphatic glands situated between the vena cava superior and the arch of the aorta.
36. Spinal nerve.
37. Superior portion of the brachial plexus.
38. Inferior portion of the brachial plexus.
39. Nerve of the serratus magnus muscle.
40. Phrenic nerve.
41. First intercostal nerve assisting in forming the brachial plexus.
42. Pneumogastric nerve.
43. Section of the fourth intercostal nerve.
44. Ninth intercostal nerve.
44′. Section of the above nerve.
45. First thoracic ganglion of the sympathetic.
46. Anastomosis of the sympathetic with the second intercostal (similar anastomoses may be seen with regard to the other intercostal nerve.)
47. Branches of the sympathetic passing to form the pulmonary plexus.
48. Great splanchnic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

We shall first call attention to the pedicle of the lung represented in this plate in section from its anterior to its posterior surface. The order of the canals which form the greater portion of it is seen to be as follows, beginning from before backwards—pulmonary veins, pulmonary arteries, and bronchial tubes. It follows therefore that an instrument passing from before backwards would involve first the pulmonary veins, then the arteries of the same name, and lastly the bronchial tubes. If the hæmorrhage from the wounded vessels did not speedily cause death, and if the bronchial tubes were opened, emphysema would follow, and sufficiently indicate the danger of the injury. Moreover, the relation of the bronchi at the upper part of the pedicle of the lung allows us to suppose that they might be wounded independently of any other organ, and we should then have an emphysema whose progress and extension to the different organs are clearly indicated by the anatomy of the parts. The air would speedily pass into the cellular tissue of the posterior mediastinum, from thence it would easily reach the cervical region where it would first be met with; afterwards it would spread to the face, head, and at the same time to the upper extremities, to the trunk and the rest of the body, which would be more or less distended according to the quantity of air that escaped from the wounded bronchus. This section of the pedicle of the lung also shows that numerous lymphatic glands exist in front and below the bronchi and between the vessels. If the glands become indurated, hypertrophied, or suppurate, they cause compression of these canals and some of the abscesses may make their way into the bronchi.

The vena azygos is seen embracing the upper part of the pedicle and placed against the vertebral column, it receives the blood from the right intercostal veins. If there is considerable effusion into the pleura, this vein is almost sure to be compressed, especially at its upper part, where it inclines more to the median line. This compression will impede the circulation in the right parietes of the thorax, and hence the œdema of the parietes accompanying certain pleuritic effusions, and which especially shows itself at the intercostal spaces, in some cases concealing these spaces and rendering the puncturing of the pleura somewhat more difficult.

The nerves are often affected by their vicinity to the pleura. Inflammation of this membrane is often accompanied with pains known as *intercostal neuralgia.* It was formerly supposed that these pains were purely neuralgic; but the investigations of M.M. Beau and Bouilland have long since shown that they sometimes depended upon inflammation of the intercostal nerve. I had the opportunity of assisting in the researches of M. Beau and have seen the intercostal nerve inflamed immediately in that portion of it which was in contact with the external surface of the pleura. The inflammation of this membrane appeared to be communicated to the nerve in consequence of its contiguity. It is this kind of neuritis which no doubt accounts for the subclavicular pains of phthisical patients, pains which in consequence of the anastomoses of the first intercostal nerves with the brachial plexus may extend into the upper extremities. If the last intercostal nerves are affected in this way, the pain is seated in the abdominal parietes sometimes even as far down as below the pubis where the ramifications of the last intercostal nerves extend. If our attention is not drawn to this circumstance, we may fall into serious errors and mistake these pleurisies, taking them, for example, for inflammation of the bladder, or for peritonitis, &c. M. Nélaton in his lectures mentions a striking example of such a mistake by medical men who were in other respects well acquainted with their profession. If the intercostal nerves are thus influenced, the sympathetic being more superficial, should be still more so. It must however be admitted that the effects of the inflammation have not been investigated, but possibly some day they will be determined and afford us a clue to a number of symptoms which are at present incapable of being explained. We know as little with respect to inflammation of the phrenic nerve which, however, is also in contact with the pleura. Its inflammation may possibly account for certain disturbances in the diaphragm which occur in certain pleurisies. May not compression of this nerve when carried to a certain extent in pleuritic effusions produce paralysis of the muscle so important in the function of respiration?

Inflammation of the pleura not only affects the nerves, but may also extend to the periosteum of the ribs and produce in these bones the same effects as ostitis whence arise the *osteophytes* pointed out by M. Parise as occurring on the ribs in the neighbourhood of chronic inflammation of the pleuræ. As these osteophytes, in some instances, acquire a considerable size, the intercostal spaces become filled up, and in performing the operation of paracentecis of the chest the trochar comes in contact with them and cannot reach the pleura.

The vertical diameter of the pulmonary cavity is less extensive on the right than on the left side. It must, however, be observed that it is only in the centre of each lateral half of the diaphragm that this difference exists, for near the ribs the limits of the pulmonary cavity are always formed by the attachments of the diaphragm over which the pleura is reflected. With regard to the transverse diameter, it presents the opposite condition to that of the vertical diameter; in short, the capacity of the right pulmonary cavity in its normal condition is somewhat greater than that of the left side. There are many individual and accidental varieties. Amongst the latter we may mention the diminution of the pulmonary cavities in the pregnant female or in those who have acsites, also in those who have a large cystic tumour of the ovary.

As the diaphragm by its convexity occupies a certain extent of the right and left thoracic cavities, it follows that penetrating wounds of the chest may pass through the pleura, diaphragm, and peritoneum, and that wounds of the chest even situated very high up may present this complication especially if the weapon has traversed the organs at the moment of a powerful expiration. In the opposite condition, that is to say when the diaphragm is strongly depressed, as in a deep inspiration, a penetrating wound of the chest, situated even very low down, will only reach the thoracic organs without injuring the diaphragm or the liver.

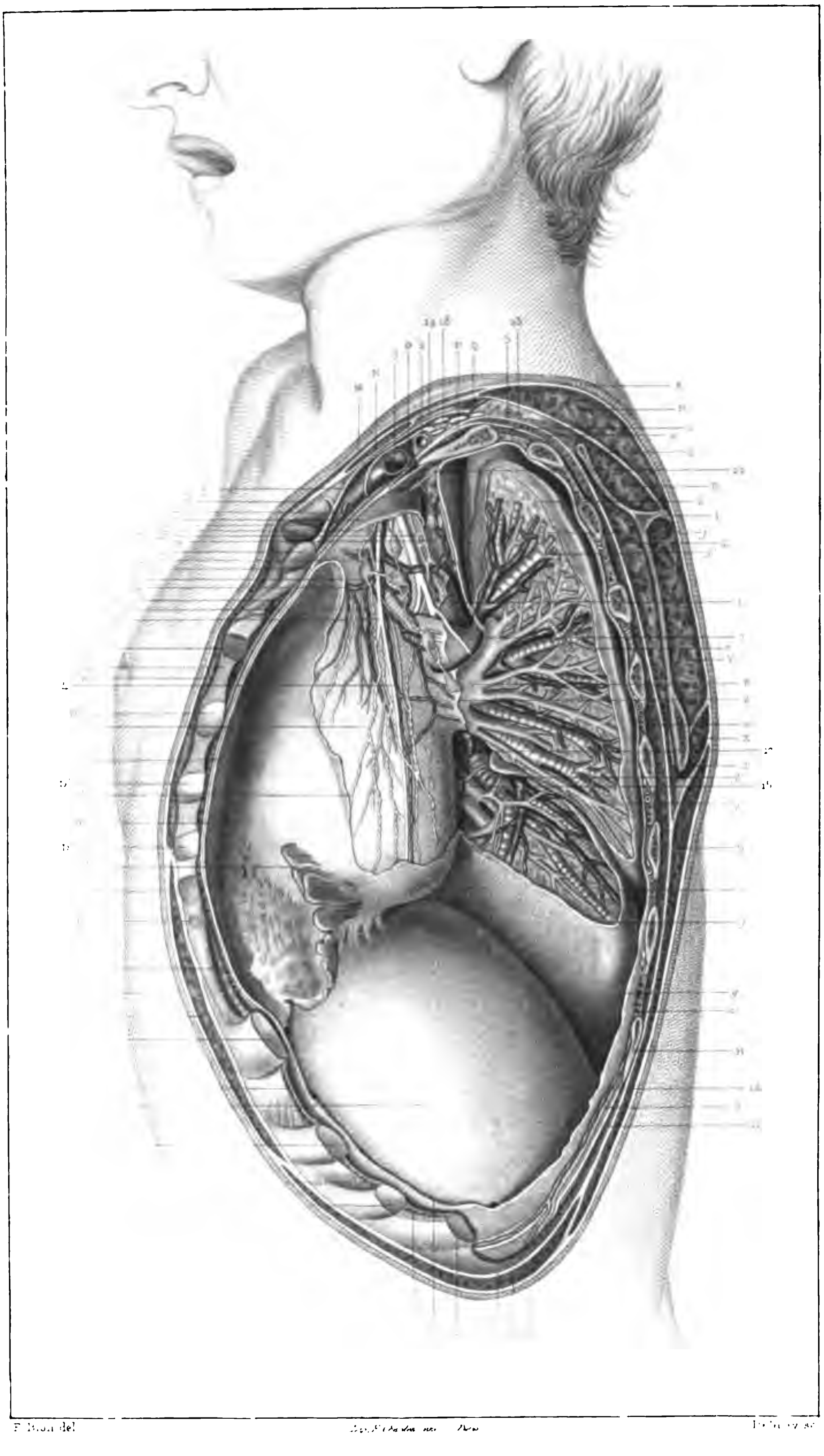

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PLATE XLVI.

Thoracic Region.

Left side of the chest.

EXPLANATION.

A. Section of the skin bounding the region.
B. Left margin of the sternum.
C. Surface of the sternum for articulating with the clavicle.
D, D′, D″, D‴. Surfaces of the sternum for articulating with the 1st 2nd 3rd 4th and 5th costal cartilages.
E, E′. Articular surface resulting from the juxta position of the 5th and 6th cartilages.
F, F′, F″, F‴. Section of the 6th, 7th, 8th and 9th costal cartilages.
G. Section of the 1st rib.
H. Section of the 9th rib.
I. Section of the spine of the scapula.
J. Section of the inferior angle of the scapula.
J′. Section of the superior edge of the scapula.
K. Section of the pectoralis major muscle.
L. Section of the rectus abdominis muscle.
M. Platysma myoides muscle.
N. Section of the clavicular fascia of the sterno-cleido-mastoideus muscle.
O. Section of the scalenus anticus muscle.
P. Section of the scalenus posticus muscle.
Q. Omo-hyoideus muscle divided.
R. Section of the trapezius muscle.
S. Section of the latissimus dorsi muscle.
T. Section of the obliquus abdominis muscle.
U. Section of the supra-spinatus muscle.
V. Section of the infra-spinatus muscle.
X. Section of the teres major muscle.
Z. Section of the subscapular muscle.
a. Section of the serratus magnus muscle.
b. Section of the triangularis sterni muscle.
c, c′, c″, c‴. Internal and external intercostal muscles divided.
d. Section of the aponeurosis covering the sterno-thyroideus and the sterno-hyoideus muscles.
e. Fibrous layer covering the parietal pleura and continuous with the aponeurosis which closes the chest above and is inserted into the margin of the 1st rib.
e′. Surface of this aponeurosis exposed, the pleura which covers it having been raised up.
f. Pleura covering the diaphragm.
g. Section of the parietal pleura.
h. Section of the pleura covering the pericardium.
h′. Fibrous prolongation covering the pericardium.
i. Section of the visceral pulmonary pleura.
j. Tissue of the lung.
j′. Ramifications of the bronchi.
k. Fatty appendix.
l. External surface of the pericardium.
l′. Section of the pericardium on the pulmonary vein.
m. Superior attachment of the pericardium to the bodies of the 2nd and 3rd dorsal vertebræ.

1. Thoracic portion of the aorta.
2. Section of the subclavian artery.
3. Internal mammary artery.
4. Phrenic artery.
5. Transverse cervical artery.
6. Intercostal artery of the 9th intercostal space.
7. Left branch of the pulmonary artery.
8. Left pulmonary veins.
9. Section of the left brachio-cephalic venous trunk.
10, 11. Internal mammary vein.
12. Pericardial venous plexus receiving the left phrenic vein.
12′. Sub-pleural vein coming from the side of the bodies of the vertebræ and forming with the preceding plexus a trunk which empties itself into the brachio-cephalic vein.
13. Section of the transverse cervical vein.
14. Intercostal vein.
15. Pulmonary vein of the inferior lobe on the root of which is seen a lymphatic gland.
16. Lymphatic gland of which the afferent lymphatic vessels accompany the pericardial and diaphragmatic veins, and the efferent vessels enter the thoracic duct situated behind the suspensory ligament of the pericardium.
17. Lymphatic gland situated at the commencement of the bronchus of the inferior lobe of the lung.
18. Section of the nerves which form the brachial plexus.
19. Phrenic nerve giving a branch to the pericardium.
20. Pneumogastric nerve giving off the recurrent nerve opposite the arch of the aorta and a little lower and behind a branch which accompanies the bronchus.
21. Intercostal nerve.
22. Ganglion of the sympathetic, giving off a branch.
23. Filament of the sympathetic accompanying the recurrent nerve to form the pulmonary plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Plate XLIII and the present one exhibit the general relations of the pleuræ and of the lungs. It is seen that the right and left pleuræ each form a kind of sac in which the lung is enclosed. The course taken by those serous membranes places their external surface in contact with the parietes of the thorax and with the surface of the lungs, hence the terms parietal pleura, and pulmonary pleura. The parietal pleura itself presents several regions, such as the costal, diaphragmatic and cardiac pleura. The pulmonary pleura is sometimes divided into the lobular pleura and the inter-lobular pleura. Inflammation of this membrane (pleurisy) may occupy one or several of these regions whence the expressions *pulmonary pleurisy*, *diaphragmatic pleurisy*, *interlobular pleurisy*, &c. One of the results of this inflammation is the formation of plastic lymph which becoming organised, forms adhesions between the surfaces of the pleural cavity. It terminates in adhesion of the pleura which if it impedes the movements of expansion in the lung may yet, in some circumstances, be of use. Roux has long since shown, that in penetrating wounds of the chest, these adhesions prevent the retraction of the lung. There are few persons who do not present more or less extensive adhesions of the internal surface of the pleuræ, and the surgeon who is called upon to administer chloroform should take into consideration the presence of these adhesions, because if they are very numerous they contra-indicate the employment of this anæsthetic. It is in the special cavity of the pleura that serum, pus, blood or air may accumulate and produce *hydrothorax*, *pyothorax*, *hæmothorax* and *pneumothorax*.

A penetrating wound of the chest almost invariably has as a result, the admission of a certain quantity of air into the open cavity of the pleura, collapse of the lung, which is then separated by a greater or less interval from the ribs, more or less difficulty of respiration, and during expiration the issue of part of the air which entered the pleura at the previous inspiration. If the wound of the chest is narrow, the air which alternately passes in and out produces a vibration of its margins and a whizzing sound which is sometimes quite loud. During inspiration the lips of the wound are pressed inwards while on the contrary they project outwards during expiration; we had the opportunity of verifying all these phenomena in the wounded of February and June in 1848. If the direction of the wound is oblique, the air becomes partly infiltrated into the surrounding cellular tissue and produces emphysema.

There are two kinds of emphysema in penetrating wounds of the chest; the first may complicate the simplest wound, it consists in the infiltration of the air into the cellular tissue of the parietes of the chest, which each inspiration introduces, or tends to introduce into the cavity of the pleura; the second occurs when the lung is wounded and is characterised by the entrance of air into the vesicles of the lung, into the cavity of the pleura, into the tissue beneath the pleura, or even into the cellular tissue of the mediastinum and subsequently into that of the whole body. The facts of this kind which have recently been pointed out by M. H. Roux are very remarkable. This infiltration is caused by the compression produced upon the lung by the thoracic parietes at the moment of expiration. This kind of emphysema sometimes occurs, even without the presence of an external wound, for instance when the jagged portions of a fractured rib has wounded the lung. While acting as house-surgeon we saw several instances of this kind of emphysema under the care of M Velpeau, and we can confirm, what had been previously stated by M. Velpeau, that under these circumstances this complication is of no importance; generally by the sixth day after the accident the emphysematous crepitation had disappeared.

On one occasion we noticed the presence of pulmonary emphysema under circumstances deserving the special attention of the surgeon. On one of the days of June 1848 a patient was attacked with tetanus and died. On making a post-mortem examination, I ascertained that air had become infiltrated into the lobules of the lung and beneath the pleura. I was struck with the circumstance, and pursuing my examination, found air in large quantities in the right and left cavities of the heart. The inferior vena cava was as large as the small intestine, and when I punctured it the air came out with a rushing sound followed by a quantity of frothy blood. The sinuses of the dura mater were empty but contained bubbles of air mixed with particles of blood. I met with a similar case in 1861 at the Hospital Necker. A patient who had been wounded and died of tetanus, presented the same amount of air in the pulmonary tissue and in the veins. In this case, death was probably caused by the presence of air in the veins. It might be supposed that chloroform had to do with the production of this emphysema; but if this could have happened in the first case, it was impossible in the second as the patient had had no chloroform.

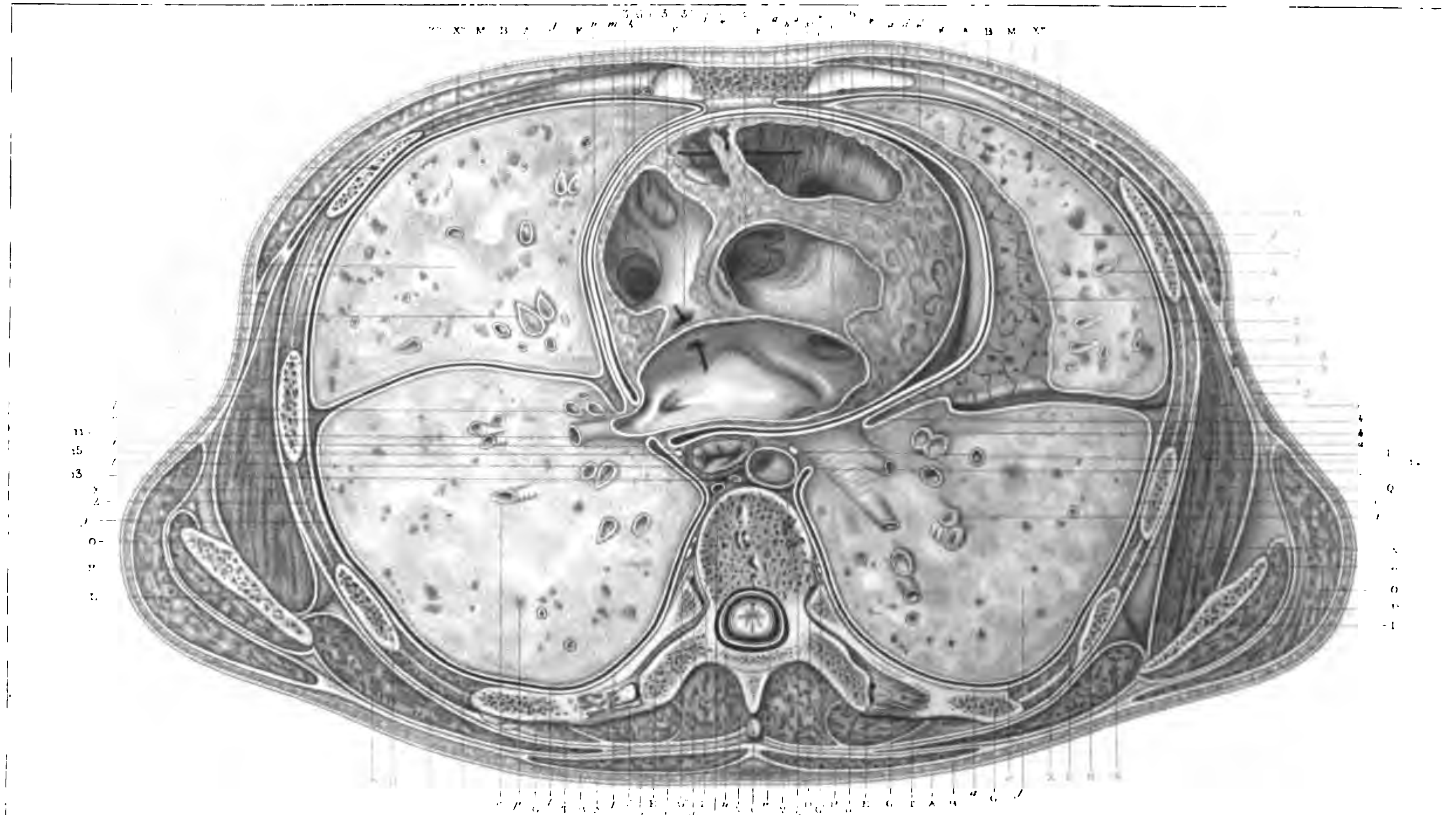
The lungs are extremely vascular and consequently very liable to inflammation; this may assume all the phases of the acute or chronic conditions. For the same reason they are also frequently the seat of special morbid formations, particularly of tubercle. The surgeon should bear in mind that the lungs are the most frequent seat of the so termed metastatic abscesses. It is seldom that purulent infection does not induce abscess in these organs. They should therefore be immediately examined when we are seeking for evidences of this serious complication of wounds and surgical operations. Other abscesses may show themselves in the lungs, such as simple abscess, or tubercular abscess. The abscesses most frequently open into the bronchial tubes and the pus they contain is expectorated; it is these abscesses which constitute *vomicæ.* In some cases the pus makes its way towards the parietes of the thorax showing itself beneath the skin through which it is discharged. These abscesses sometimes become fistulous: hence arise *pulmonary fistulæ;* abscesses in the pleura may also make their way towards the skin and form *pleural fistulæ.*

Pressed on all sides during the act of expiration, the lungs are liable to be displaced, and have a tendency to escape through any artificial opening, it is in this way that hernia of the lungs is produced, a subject which has been carefully studied by M. Morel Lavallée surgeon to the Hospital Beaujon.* When the lung escapes through a wound its circulation is greatly impeded, the venous blood brought to it by the pulmonary artery is arrested in its course and increases the size of the hernia, giving to it the black appearance which it rapidly acquires in contact with the air. It is this appearance which leads to the supposition of its being in a state of gangrene when it is merely congested. This circumstance should put us on our guard against attempting to excise the part which we might be induced to do if merely guided by the colour. When the hernia is reduced, the protruded portion rapidly recovers its natural functions.

When there is a wound of the lung with internal hæmorrhage, what should be done? It has been recommended to open the wound; on the contrary, our opinion is that the wound should first be closed, provided always that a free opening is furnished for the exit of the blood in the event of the hæmorrhage threatening to suffocate the patient. When there is an effusion of blood into the pleura, Valentin believed it could be recognised by the ecchymosis which subsequently shows itself in the lumbar region. This symptom is far from possessing the value that has been assigned to it, and we believe that the presence of the ecchymosis in conjunction with the hæmorrhage is merely a matter of coincidence.

Being very vascular, the ribs are sometimes affected with caries, necrosis, and even cancer, diseases which necessitate the resection of the diseased part. Although rarely performed, this operation is facilitated by dissecting of the periosteum. The danger of wounding the pleura or the intercostal artery and nerve which accompany the rib is diminished by the plastic exudations, formed on the inner surface of the rib. A chain saw or a strong pair of Liston's forceps are sufficient to remove the diseased portion of the rib.

See ***Mémoires de la Société de Chirurgie,*** Sur les hernies du poumon par M. Morel Lavallée. Tome I. p. 75.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XLVII.

Region of the Thorax.

A transverse and horizontal section of the chest on a level with the eighth vertebra.

EXPLANATION.

A. Section of the skin.
B. Section of the superficial fascia.
C. Section of the spinous process of the seventh dorsal vertebra.
D. Section of the body of the eighth dorsal vertebra.
E. Transverse process of the eighth dorsal vertebra.
F. Section of the sternum.
G. Section of the seventh rib.
G′. Posterior costal transverse ligament.
G″. Stellate or costo-vertebral ligament.
H. Section of the sixth rib.
I. Section of the fifth rib.
J. Section of the fourth rib.
K. Section of the costal cartilage of the third rib.
L. Section of the inferior angle of the scapula
M. Section of the pectoralis major muscle.
N. Section of the pectoralis minor muscle.
O. Section of the latissimus dorsi.
P. Section of the teres major muscle.
Q. Section of the serratus magnus muscle.
R. Section of the trapezius muscle.
S. Section of the rhomboideus muscle.
T. Section of the sacro-lumbalis muscle.
U. Section of the longissimus dorsi muscle.
V. Section of the transversalis dorsi muscle.
X. Section of the external intercostal muscle of the sixth intercostal space.
Z. Section of the internal intercostal muscle of the sixth intercostal space.
X′ Section of the external intercostal muscle of the fifth intercostal space
Z′. Section of the internal intercostal muscle of the fifth intercostal space.
X″. Section of the external intercostal muscle of the fourth intercostal space.
Z″. Section of the internal intercostal muscle of the fourth intercostal space.
X‴. Section of the external intercostal muscle of the third intercostal space.
Z‴. Section of the internal intercostal muscle of the third intercostal space.
a. Section of the left parietal pleura.
a′. Section of the pleura on a level with its reflexion on to the pericardium.
b. Section of the pleura of the pericardium.
b′. Reflection of the pericardial pleura on to the pedicle of the left lung.
c. Section of the pleura of the inferior lobe of the lung.
c′. Reflexion of the pleura of the lung on to the body of the eighth dorsal vertebra passing to form the parietal or costal pleura.
d. Section of the pleura covering the inferior lobe of the left lung.
e. Inter lobular fissure and pleural cavity.
f. Section of the inferior lobe of the left lung.
g. Section of the superior lobe of the left lung.
g′. Internal surface of the lung covered by the pleura.
h. Section of a bronchial ramification in the superior lobe of the lung.
h′. Section of two of the bronchial ramifications in the inferior lobe of the lung.
i. Section of the ramifications of the bronchi in the inferior lobe of the left lung.
j. Section of the right parietal pleura.
j′. Reflexions on to the pericardium of the right parietal pleura.
k. Section of the pleura covering a portion of the pericardium.
l. Section of the pleura covering the inferior lobe of the right lung.
m. Section of the pleura covering the anterior surface of the middle lobe of the right lung.
n. Section of the pleura covering the pericardial surface of the middle lobe of the right lung.
o. Cavity of the pleura on a level with the interlobular fissure.
p. Section of the inferior lobe of the right lung.
q. Section of the middle lobe of the right lung.
r. Section of the bronchial ramifications in the middle lobe of the right lung.
r′. Section of one of the bronchial divisions of the inferior lobe of the right lung.
s. Section of the pericardium.
s′. Section of the serous fold of the pericardium covering the heart.
t. Section of the œsophagus.
u. Section of the dura mater of the spinal cord lined on its inner surface by the arachnoid.
v. Section of the pia mater of the spinal cord and of the visceral fold of the arachnoid.

1. Opening of the left auricle into the corresponding auricle.
2. Infundibulum of the left ventricle on a level with the aortic opening on which may be seen the three semilunar valves (left ventricle).
3. Opening of the superior vena cava.
3′. Opening of the auricle into the right auricle.
3″. Inter-auricular opening or foramen of Botal with its valve and in which is seen a bristle indicating the persistence of the opening in this specimen.
4. Opening and infundibulum of the pulmonary artery divided into two portions by a fleshy column (a bristle is inserted to show this arrangement).
5. Section of the thoracic aorta.
6. Section of the internal mammary artery.
7. Section of the internal mammary vein.
8. Section of the external thoracic artery.
9. Section of the internal thoracic vein.
11. Section of a pulmonary vein in the inferior lobe of the right lung.
12. Section of the vena azygos.
13. Section of the thoracic duct.
14. Section of the left pneumogastric nerve.
15. Section of the right pneumogastric nerve.
16. Section of the right sympathetic.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In this section is shown the relations of the anterior and posterior mediastinum to the cavities of the pleura and of the pericardium. We may also judge of the relative thickness of the thoracic parietes in the several regions. The section presents a kind of resumé of the previous plates, and from it might be drawn the various practical conclusions which have been previously mentioned.

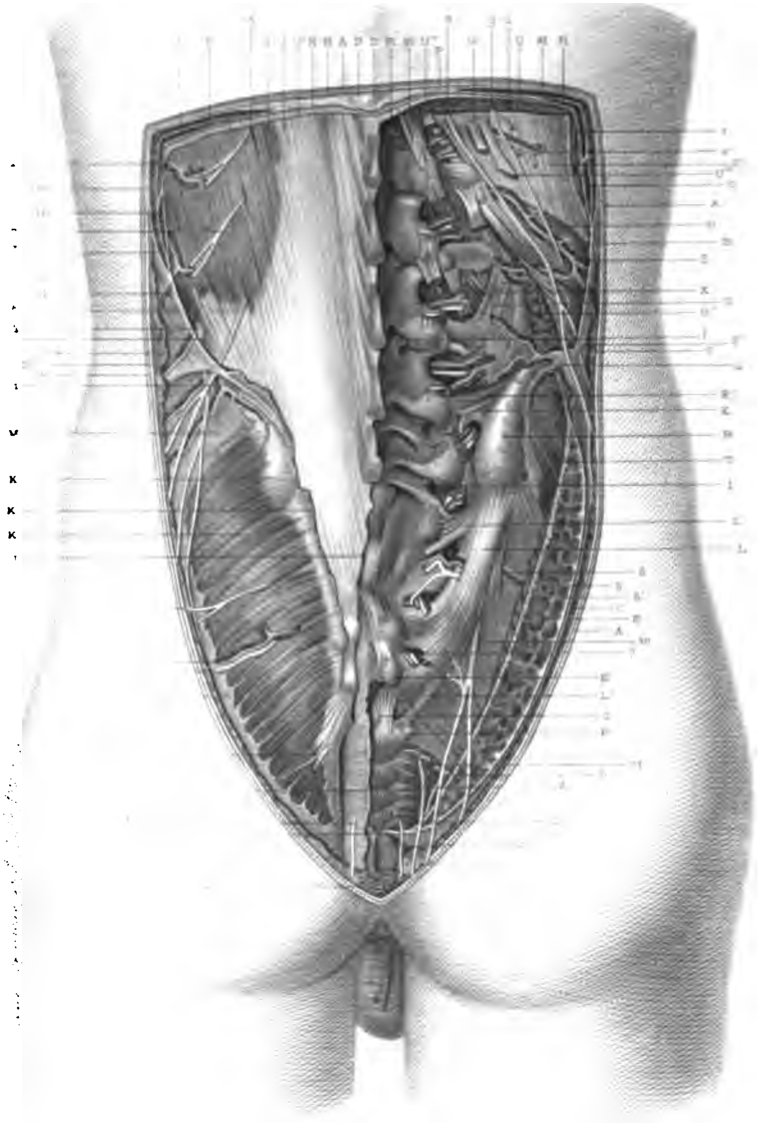
We shall now, however, refer to certain additional facts which are deserving of special attention.

With regard to the pleura we may point out its distribution over the parietes of the thorax and over the surface of the lung. The external surface corresponding to the parietes, to the intercostal spaces and to the inner surface of the ribs is not intimately attached to the subjacent organs, so that it is easily separated from them. When the membrane is inflamed, it becomes thickened and separates still more readily. In consequence of this, it must be admitted that in puncturing the thorax the membrane may be pushed towards the lung without opening it, so that the fluid beneath will not escape because the point of the trochar has not entered the cavity in which the effusion has taken place. In order to avoid this mishap, the trochar should be thrust in quickly and firmly as in endeavouring to penetrate a tense membrane. The pleura does not yield like the peritoneum which explains why a hernia of the lungs is not furnished with a serous sac like an abdominal hernia.

The superior cul-de-sac of the pleura sometimes ascends as high as above the clavicle. In the case of persons troubled with old and obstinate coughs and who make great efforts because of the pulmonary emphysema which results from chronic bronchitis, the lung becomes developed above where it meets with the least resistance, and hence there arises a cul-de-sac which ascends to a greater or less height. The presence of the pleura at the lower part of the neck should be known to the surgeon, who would avoid opening it in any operations he may perform in the subclavicular region. Some lymphatic vessels belonging to the upper part of the pleura and of the lung empty themselves into the cervical glands, hence the possibility of inflammation of these glands and the presence of deep-seated abscesses of the neck accompanied with inflammation of the pleura and of the lung. Tubercular disease may extend in the same way, as well as cancer and other tumours which are capable of being developed in the lung or in the pleura.

The lung is elastic, vascular, and at the same time always in contact with the inner surface of the ribs from which it is only separated by the two layers of the pleura. We have already seen that the fragments of a fractured rib may wound this organ, giving rise to emphysema and to bloody sputa, which are characteristic of this lesion. It must, however, be remembered that these phenomena may be present when there is no fracture. This is explained by the elasticity of the ribs and of the costal cartilages. Suppose, for instance, that a violent blow is received on the side of the chest, the parietes of the thorax will be strongly depressed, and if, under these circumstances, the lung does not speedily collapse as in the act of expiration, or if it is dilated, it offers a certain amount of resistance to the depression, and should this be very marked it will give rise to a rupture of the pulmonary tissue. M. Gosselin has long since called attention to the contusions and lacerations of the lung which may be caused in this way.

How do wounds of the lungs heal up? Authors are not agreed upon this question. Some have supposed that the lung collapsing becomes contracted, and so obliterates its vessels and the openings of its canals. This explanation may be correct in some cases, as for instance in pneumo-thorax but does not apply to cases where the lung does not pass into a state of contraction. In the latter case, the following is what takes place: around the point of injury such an amount of congestion and swelling takes place as is sufficient to bring the margins of the wound together, these margins soon contract, become adherent and cicatrisation takes place. The plastic lymph furnished by the pleura contributes greatly to the cure.



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LIBRAIRIE GERMER BAILLIERE.

PLATE XLVIII.

Lumbo-Sacral Region.

Superficial Layer.

EXPLANATION.

LEFT SIDE (*first layer*).

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the deep fatty fascia.
D. Spinous process of the twelfth dorsal vertebra.
E. Last piece of the coccyx.
F. Section of the latissimus dorsi muscle.
G. Section of the serratus posticus inferior muscle.
H. Section of the inferior fascia of the serratus posticus inferior.
H′. Aponeurotic tendon, common to the latissimus dorsi and the serratus posticus inferior muscles, inserted into the crest of the ilium.
I. Fibres of the muscles common to the region.
J. Aponeurotic fibres of the same.
J′. Section of the aponeurotic fibres of the common mass near its termination in the median line.
K. Glutæus maximus muscle.
K′. Aponeurotic fibres of the glutæus maximus inserted into the superior curved line of the ilium.
K″. Section of the aponeurosis covering the tendinous fibres of the general mass and prolongation of insertion of the glutæus maximus into the spinous processes of the lumbo-sacral vertebræ.
L. Aponeurosis of the glutæus maximus.
M. Aponeurosis of the glutæus medius serving for the insertion of the superior fibres of the glutæus maximus.
N. Posterior fibres of the sphincter ani muscle.
O. Section of the fibrous membrane forming part of the posterior wall of the sacral canal and continuous below with the perineal aponeurosis Between this membrane and the superior half of the coccyx is a cavity containing fat in which is a prolongation of the sacral canal.

1. Terminal ramifications of the ilio-lumbar arteries accompanied by their veins.
2. Terminal ramifications of the first lumbar artery accompanied by their veins.
3. Ramifications of the second lumbar artery with its veins.
4. Ramifications of the third lumbar artery with its veins.
5. Superficial ramifications of the gluteal arteries accompanied by their veins and nerve.
6. A branch of the tenth intercostal nerve.
7. A branch of the eleventh intercostal nerve.
8. A branch of the first pair of lumbar nerves.
9. A branch of the first pair of lumbar nerves more deeply seated than the preceding and going to be distributed to the skin of the gluteal region.
10. Posterior branch of the third pair of sacral nerves.
11. Posterior branch of the fourth pair of sacral nerves.
12. Posterior branch of the fifth pair of sacral nerves.
13. Posterior branch of the sacral plexus going to be distributed to the skin of the ano-coccygeal region.

RIGHT SIDE (*second layer.*)

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the deep fatty fascia.
D. Spinous process of the twelfth dorsal vertebra.
E. Right tubercle of the spinous process of the last piece of the sacrum.
F. First piece of the coccyx.
G. Transverse process of the twelfth dorsal vertebra.
H. Posterior superior spine of the ilium.
I. Posterior ligament of the articular processes of the lumbar vertebræ.
I′. A strong ligament uniting the sacrum to the last lumbar vertebra.
J. Posterior ligament uniting the last piece of the sacrum to the first piece of the coccyx.
K. Ilio-lumbar ligament.
L. Posterior vertical ilio-sacral ligament.
L′. Posterior portion of the posterior ilio-sacral ligament inserted into the first articular tubercle of the sternum.
L″. Inferior portion of the vertical posterior sacro-iliac ligament going to be inserted into the superior extremity of the coccyx.
M. Section of the latissimus dorsi muscle.
N. Section of the superior fibres of the serratus posticus inferior muscle.
O. Section of the inferior fibres of the serratus posticus inferior muscle.
P. Aponeurotic insertion of the serratus posticus inferior and the latissimus dorsi muscles.
P′. Aponeurotic insertion into the crest of the ilium of the serratus posticus inferior and the latissimus dorsi muscles.
Q. Section of the general mass of the muscles.
R. Section of the interspinales dorsi muscle.
R′. Fibres of the same muscle inserted into the tubercle of the articular process of the first lumbar vertebra.
R″. One of the tendons of the interspinales dorsi.
S. Section of the glutæus maximus muscle.
S′. Section of the aponeurosis of the same muscle.
T. Fibres of the glutæus medius muscle.
U. Posterior and middle fibres of the quadratus lumborum muscle.
U′. Fibrous portion of the quadratus lumborum going to be inserted into the last rib.
U″. Section of the inferior fibres of the quadratus lumborum muscle.
U‴. Tendon of insertion of the quadratus lumborum.
U⁗. One of two tendons inserted into the transverse process of the twelfth dorsal vertebra belonging to the quadratus lumborum (similar insertions of the quadratus lumborum are attached to the first and second lumbar vertebræ.)
V. Fibrous bands of the quadratus lumborum.
X. One of the interspinales muscles of the lumbar region.
Z. Coccygeus muscle.
a. Sphincter ani muscle.

1. Terminal branch of the eleventh intercostal artery.
2. Branch of the last intercostal artery.
2′. Branch of the first lumbar artery.
3. External branch of the second lumbar artery.
4. Ramifications of the ilio-lumbar artery anastomosing with the third and fourth lumbar arteries.

5. Posterior branch of sacral artery issuing through the third posterior sacral foramen.
6. Posterior branch of the ischiatic artery anastomosing with the posterior sacral arteries.
7. The last posterior sacral artery accompanied by a vein and a nerve.
8. Posterior branch of the eleventh pair of intercostal nerves.
9. External branch of the eleventh pair of intercostal nerves.
10. Posterior sacral nerves emerging from the third sacral foramen, and forming the largest of the posterior sacral nerves.
11. Anal nerve coming from the sacral plexus.
12. Anal nerve (small branch) going to the sphincter and the skin around the anus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The lumbar region presents a curve or concavity more or less developed in different individuals and in different races, but which is always larger in woman than in man; in market women who carry baskets against their stomachs, and also in pregnant women who draw their body backwards in order to preserve their equilibrium, the concavity of the lumbar region is increased. In some diseases this concavity is more or less altered. Thus in disease of the hip joint it becomes more marked. In affections of the spine, if the curvature is directed to the right, in the lumbar region there is a concavity towards the left, forming what is termed the curve of compensation. This region is often affected in Potts' disease, but then the irregularity occurs in the antero-posterior direction, and the convexity is behind.

Wounds in this region which only affect the superficial layer are seldom of any importance, from whatever cause they may arise. They do not often even produce inflammation and still more rarely hæmorrhage.

Contusions are sometimes serious when they involve the general mass of the muscles or the bones; the latter are, however, well protected by the muscles and aponeuroses by which they are surrounded. The large and strong aponeurosis, which serves at the same time both as a sheath and as a means of insertion to the sacro-lumbar muscles, to the longissimus dorsi, and to the transversalis dorsi, often affords a very secure protection to the deeper seated organs. Thus, a bullet which impinges obliquely on this fibrous membrane may easily glide over it, become turned from its course and pass out of the body, or at least remain lodged in the subcutaneous tissues.

In endeavouring to lift up a heavy weight, or to raise oneself from a stooping position, a sudden and acute pain sometimes occurs in the lumbar region and is occasionally accompanied by a slight noise like the cracking of a whip, this is vulgarly termed twisting the kidney (*tour de rein*). It has long been endeavoured to explain this phenomenon, it has been said, for instance, that a sort of hernia of the muscular fibres was formed through the fibres of the aponeurotic membrane, and that the muscle being compressed, or as it were strangulated in the fissure, became acutely painful. We do not believe this explanation is correct. We are more inclined to consider that some of the muscular fibres are ruptured, and that when an attempt at contraction takes place it causes pain. A similar pain occurs in acute affections of the kidneys and in rheumatism of the part which is then termed *lumbago*. At the commencement of small pox there is often a very acute pain in the lumbar region.

In the sacral region, the skin, so to speak, rests immediately upon the bones and upon the fibrous membranes which connect them together so that the fatty cellular tissue scarcely separates the one from the other. When in consequence either of disease or of an accident, a person is compelled to remain for a considerable time on his back, the weight coming upon the sacrum, the skin is subject to constant pressure between the bed and the body. The skin ceases to be nourished; it gradually wastes, becomes of a red colour, inflames, ulcerates, and sometimes mortifies, as is seen to be the case in typhus fever, and hence there arise *eschars* on the surface of the sacrum as one of the complications of severe fevers. This complication must be avoided by frequently changing the position of the patient and by the use of astringent lotions and tonics. This is very important as the eschars, when they become detached, sometimes leave the sacrum entirely exposed and the spinal canal open, so that the inflammation extends to the membranes of the spinal cord itself. This accident, which had been pointed out by Blandin, has been noticed since by several observers, M. Broca, amongst others, recently communicated to the Société de Chirurgie, a case which proved that M. Blandin's remarks were correct.

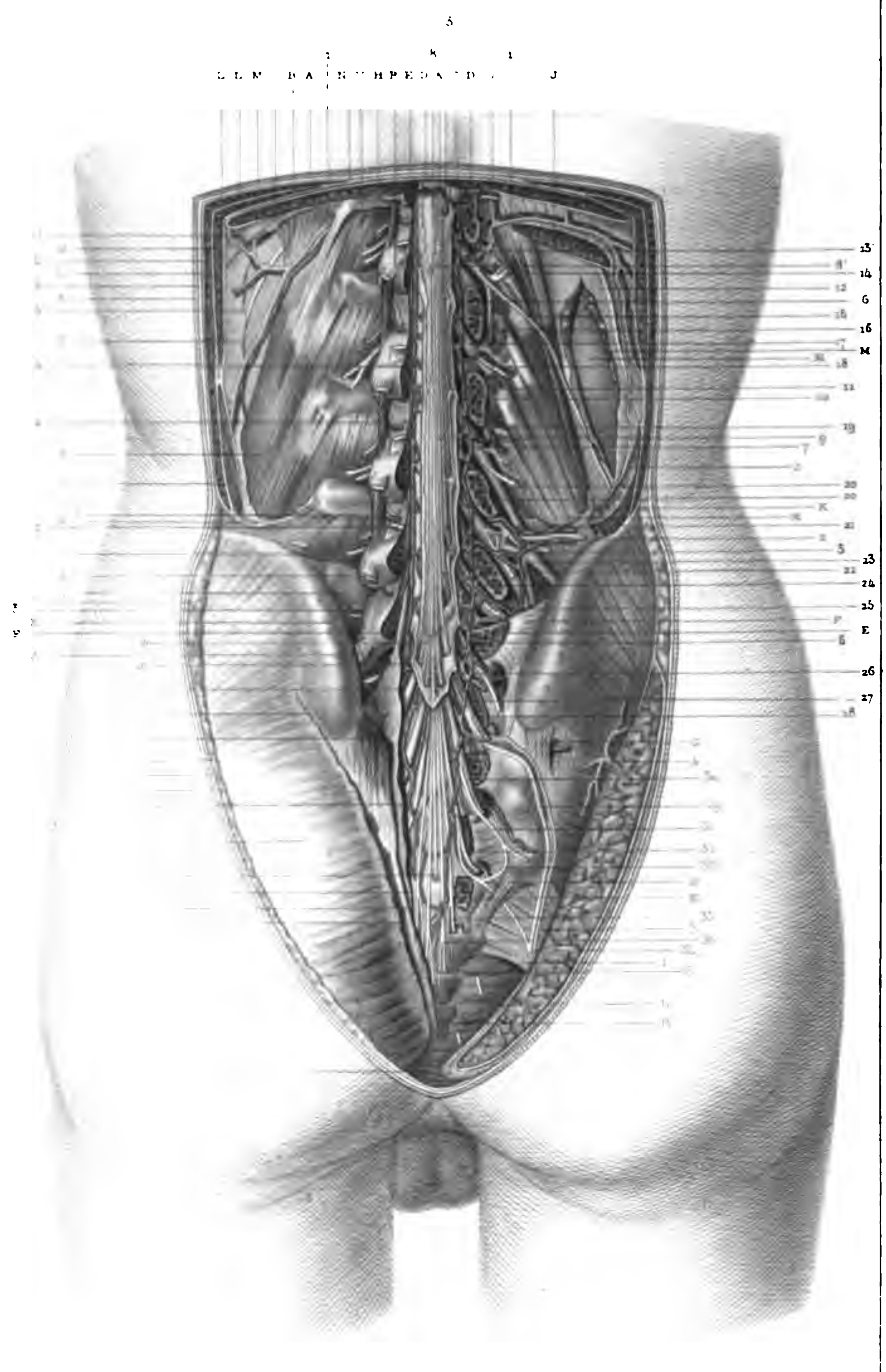
The sacrum is connected to the vertebral column and to the ilium by powerful ligaments which scarcely allow of any motion in this bone. Yet, in accidents accompanied with extreme violence, the sacrum together with the coccyx, has been seen displaced downwards, in the same way as a wedge would be which had separated the iliac bones. During my residence at the Hôpital de la Charité, in 1850, under M. Velpeau I saw a patient in whom the sacrum was dislocated downwards and forwards. This dislocation is extremely rare and beyond the resources of the surgeon, death will ensue, not only on account of the direct violence done to the part, but also in consequence of the injuries to the viscera which necessarily accompany it, either those of the pelvis, of the abdomen or of any of the other visceral cavities.

Caries of the sacrum is not uncommon. The bone, in fact, is very vascular, and exposed to injuries which render it liable to this disease. Certain cases of anal fistula have their origin in this disease of the sacrum.

The articulation of the sacrum with the coccyx is liable to dislocation; thus, in falls upon the buttocks, we sometimes find the coccyx driven within the pelvis and the apex of the bone pressing upon and irritating the rectum, giving rise to very acute pain which must be relieved by the immediate reduction of the bone.

I have seen a lady who after a fall had an acute neuralgic pain which undoubtedly arose from displacement of the coccyx.

During labour, the sacro-coccygeal articulation, in consequence of its mobility, assists in enlarging the antero-posterior aperture of the pelvis, and thus facilitates the passage of the child's head. When this articulation is ossified, as naturally happens in the woman at about forty years of age, this extension cannot take place and the passage of the fœtus is prevented, so that it is sometimes necessary to employ the forceps in order to overcome this impediment.



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LIBRAIRIE GERMER BAILLIÈRE.

PLATE XLIX.

Lumbo-Sacral Region.

Deep layer.

EXPLANATION.

LEFT SIDE (*first layer*).

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Subcutaneous fatty tissue.
D. Spinous process of the last dorsal vertebra.
E. Section of the lamina of the last dorsal vertebra.
F. Section of the lamina of the last lumbar vertebra.
G. Section of the posterior wall of the sacral canal.
G′. Inferior termination of the section of the posterior wall of the sacral canal.
H. Transverse process of the first lumbar vertebra.
I. Transverse process of the last lumbar vertebra.
J. Twelfth rib.
K. Crest of the ilium forming the posterior superior spine of the ilium.
L. Section of the latissimus dorsi muscle.
L′. Section of the aponeurosis of the latissimus dorsi.
M. Section of the serratus posticus inferior.
N. Section of the fibrous layer into which the latissimus dorsi and serratus posticus inferior muscles are inserted in the direction of the median line.
N′. Aponeurotic layer common to the latissimus dorsi, the serratus posticus inferior and the transversalis abdominis muscles passing to be inserted into the crest of the ilium and into the apex of the transverse process of the fourth lumbar vertebra.
O. Section of the muscles situated in the sacral groove.
O′. Fibrous membrane belonging to the lower end of the general muscular mass.
P. Section of the transversalis dorsi muscle.
Q. The glutæus maximus muscle covered by its aponeurosis.
Q′. Section of the aponeurotic fibres of the glutæus maximus passing to be inserted into the line of the spinous processes of the sacrum.
R. Sphincter muscle of the anus.
S. Transverse muscle of the abdomen.
T. Quadratus lumborum muscle.
T′. Aponeurosis of the quadratus lumborum muscle.
U. First of the intertransversales lumborum muscles.
U′. Last of the intertransversales lumborum muscles.
V. Small muscles passing from one spinous process to the other, (these muscular fibres are not described by writers).
X. The last of the tendons of insertion of the longissimus dorsi muscle.
X′. Another of these tendons, similar tendons belonging to the same muscle are seen attached to the other processes.
Z. First tendon of insertion at the fourth lumbar vertebra for the transversalis dorsi muscle.
a. Section of the dura mater of the spinal cord.
b. Arachnoid membrane of the spinal cord.
c. Median ligament of the spinal cord united to the periosteum of the sacrum.

1. Ramification of the last intercostal artery accompanied by its vein and nerve.
2. Posterior and internal branch of the third lumbar artery (each lumbar artery gives off a similar branch).
3. Posterior and external branch of the last lumbar artery.
4. Posterior longitudinal sinus of the spinal cord.
5. External branch of the first pair of lumbar nerves.

RIGHT SIDE (*deep layer*).

A. Spinous process of the last dorsal vertebra.
B. Last piece of the coccyx.
C. Articular process of the first lumbar vertebra.
D. Section of the pedicle of the lamina of the first lumbar vertebra.
E. Section of the pedicle of the lamina of the first vertebra of the sacrum.
E′. Section of the pedicle of the lamina of the last vertebra of the sacrum.
F. Ilio-lumbar ligament.
G. Deep fibres of the posterior vertical sacro-iliac ligament.
H. Lateral sacro-coccygeal ligament.
I. Great sacro-sciatic ligament.
J. Section of the quadratus lumborum muscle at its lower part.
J′. Section of the quadratus lumborum at its upper part.
J″. Tendon of the quadratus lumborum inserted into the transverse process of the first lumbar vertebra.
K. Psoas muscle.
K′. Section of the aponeurosis of the psoas muscle.
L. Ischio-coccygeal muscle.
M. Posterior surface of kidney in contact with the psoas and quadratus lumborum muscles.
M′. Section of the fatty mass surrounding the kidney.

1. First lumbar artery anastomosing with the last intercostal.
2. Ilio-lumbar artery divided and anastomosing with the last lumbar artery accompanied by its veins.
3. Inferior branch of the last lumbar artery.
4. Terminal and anastomosing branches of the gluteal artery.
5. Large arterial branch emerging from the second sacral foramen distributed to the lower part of the gluteal region.
6. Terminal venous plexus of the sinuses of the spinal cord.
7. Longitudinal sinus of the spinal cord communicating with the lumbar veins.
8. Inferior extremity of the spinal cord.
8′. Line of demarcation between the origin of the nerves and the spinal cord.
9. The chorda equina.

11. Ligamentum dentatum.
12. Anterior branch of the first pair of lumbar nerves.
13. Posterior root of the second pair of lumbar nerves.
13′. Ganglion of the second pair of lumbar nerves opposite the foramen of conjugation.
14. Posterior branch of the second pair of lumbar nerves,
15. Ilio-hypogastric nerve of the lumbar plexus.
16. Anastomosis of the second and third pair of lumbar nerves.
17. Ganglion of the third pair of lumbar nerves.
18. Posterior branches of the third lumbar nerve.
19. Ganglion of the fourth pair of lumbar nerves.
20. Posterior branch of the fourth pair of lumbar nerves.
20′. Fourth lumbar nerve anastomosing below with the fifth lumbar nerve to form the lumbar plexus.
21. Ganglion of the fifth lumbar nerve.
22. Small posterior branch of the fifth pair of lumbar nerves.
23. Nervous plexus formed by the fourth and fifth lumbar nerves.

24. First pair of sacral nerves.
25. Small posterior branch of the first sacral nerve.
26. Second pair of sacral nerves.
27. Posterior branch of the second pair of sacral nerves.
28. Third pair of sacral nerves.
29. Posterior branch of the third sacral nerve anastomosing below with the posterior branch of the fifth sacral nerve.
30. Fourth pair of sacral nerves.
31. Posterior branch of the fourth pair of sacral nerves.
32. Fifth pair of sacral nerves.
33. Anastomosis of the posterior branch of the fourth sacral nerve with the posterior branch of the fifth sacral nerve.
34. Nerve-trunk formed by the posterior branches of the third and fifth sacral nerves.
35. Sixth pair of sacral nerves.
36. Termination of the posterior sacral nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds inflicted on the lumbar region with a pointed instrument may be complicated with penetration of the spinal canal and injury to the nerves forming the chorda equina causing more or less paralysis of the lower extremities according to the number of nervous filaments which have been injured; this penetration of the canal is easily accounted for by the amount of separation between the laminæ of the lumbar vertebræ. In the sacral region this penetration is more difficult because the canal only communicates with the soft parts through oblique and rather small foramina.

Abscesses and fistulæ are not uncommon in the lumbo-sacral region. We meet with phlegmonous abscesses, with abscesses caused by caries of the bones, and with symptomatic abscesses. The first may be situated in any of the cellular interspaces, beneath the skin, in the sheath of the general mass of the muscles, in that of the quadratus lumborum muscle, or in that around the kidneys. Abscesses containing disintegrated osseous matter may depend upon disease of the laminæ, of the spinous processes, or of the bodies of the vertebræ. Symptomatic abscesses may be connected with the kidney, peritoneum, ovary, or iliac fossa; in the sacral region abscesses are often due to sacrocoxalgia. The aponeurosis of the transverse muscle which is inserted into the transverse processes often forms a separation between these abscesses. For instance, the pus which comes from the anterior part of the bodies of the vertebræ, or from the abdominal or pelvic organs, being retained by this aponeurosis, presents itself at the anterior openings of the abdomen, while that which comes from the sides, the laminæ, or the spinous processes passing behind, makes its way into the lumbo-sacral region. But, it must be borne in mind that deep abscesses often break through this boundary and nothing is more common than to see abscesses of the iliac fossa opening in the lumbar region. Within the last few years I have had to treat three abscesses of the iliac fossa, two of which I opened in the lumbar region where they formed a well marked projection; while the third opened spontaneously. I succeeded in curing all three. I have always found the introduction of Canquoin's paste into the opening very useful.

Although the bodies of the lumbar vertebræ are thick and large, it is not uncommon to find them fractured in various ways. In falls from great heights or even in violent movements of the body backwards, the bodies of these vertebræ are more frequently fractured than even those of the dorsal or cervical regions. This happens first because the bodies of these vertebræ are very spongy, and secondly because the lumbar vertebræ have no lateral articulations which can furnish them with a point of resistance and take off the effects of the blow. The superficial position of the spinous processes of the lumbar vertebræ also explains their being fractured separately, as well as the fracture of the laminæ of the same vertebræ from shock (*contre coup*).

Various tumours may occur in the lumbo-sacral region, amongst them we may especially mention spina bifida, scrotal tumours and hernias.

The most frequent situation for spina bifida is certainly in this region, which is explained by the mode of development of the vertebral column. It has latterly been observed that several congenital tumours of the sacrum contained the remains of fœtuses and were therefore only monstrosities by inclusion. M. Giraldès exhibited a very beautiful specimen at the Société de Chirurgie. In some cases these tumours may be successfully removed.

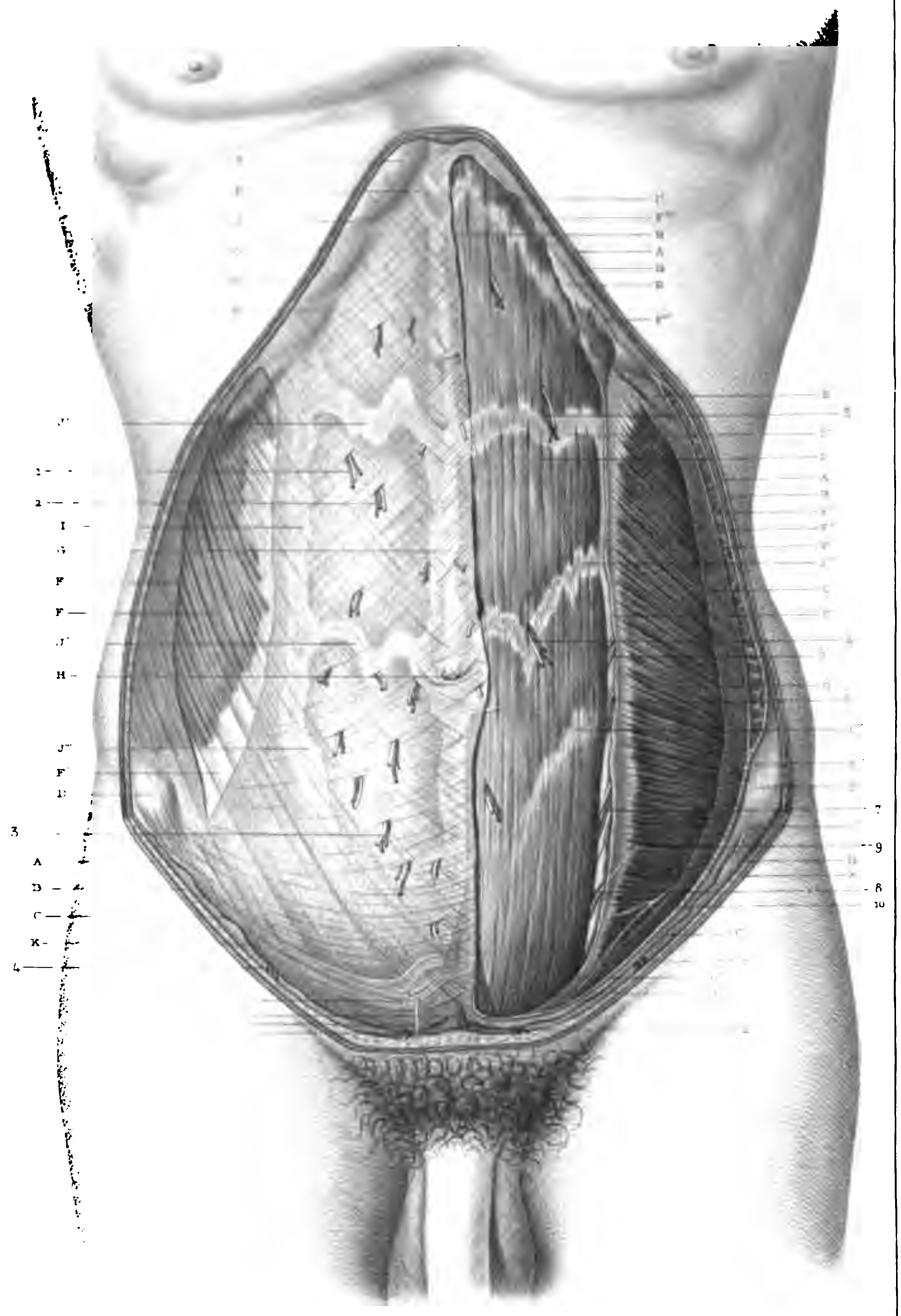
J. L. Petit gave the name of ***lumbar hernia*** to a hernia which appears between the false ribs and the posterior portion of the crest of the ilium, Blandin and J. Cloquet have also seen this form of hernia. These cases seem to us to be explained by the arrangement of the muscular layers which offer somewhat less resistance posteriorly although they are still sufficiently strong only to allow of the protrusion of the viscera but very rarely at this part.

Three special operations have been performed in the lumbar region, these are nephrotomy, ligature of the aorta, and the formation of artificial anus. Many cases are on record where calculi having become arrested in the kidney or in the pelvis of the kidney have acquired a very considerable size; hence arose the idea of ***nephrotomy***, an operation which consists in reaching the posterior surface of the kidney, through the lumbar region, by passing between the sacro-lumbar mass of muscles and the posterior margin of the oblique muscles. "This operation," says M. Velpeau, "can only be proposed in those rare cases where the loin has become the seat of a distinct fluctuation that has been preceded by all the symptoms of stone in the kidney, and enables us readily and easily to reach the centre of the disease; or in cases where a fistulous opening enables us directly to touch the stone with an exploratory instrument; or further where the stone itself projects towards the exterior and can be felt through the integuments." The researches of M. Rayer on renal calculi have thrown a new light upon this question, and it is to be hoped that the operation which has hitherto been merely suggested will never be put into practice. M. Velpeau has twice operated but confined himself to opening a large abscess which surrounded the calculi.

It was in this region that Astley Cooper made his incision for the purpose of ligaturing the aorta with the view of curing an aneurism situated high up on the external iliac artery. M. Fano has lately advocated this operation. The distribution of the peritoneum enables us in the dead body to apply a ligature to the aorta without opening that serous membrane; all that is necessary is to make in the lumbar region, externally to the common muscular mass, a parallel incision and to raise up the peritoneum from the sides of the vertebral column as far as the vessel, but this plan does not answer in the living subject. The operation has been performed three times and in each case it was followed by the death of the patient.

In cases of imperforate anus, whether in the rectum or in the lower intestines, Callisen has proposed to open the abdomen in the left lumbar region. On this side the descending colon is not generally covered by the peritoneum throughout its entire extent, so that it is possible to open the intestine without wounding that membrane of which the inflammation is so dangerous. In performing this operation, the skin, the fatty subcutaneous tissue, the latissimus dorsi, obliquus externus and internus, and the transversalis muscles, the aponeurosis of the transversalis, and the subintestinal cellular tissue are successively divided. Instead of the vertical incision of Callisen, Amussat made a transverse incision about two fingers breadth above the crest of the ilium commencing at the external margin of the general muscular mass, and carrying it outwards to the extent of from seven to eight centimetres (2·75 to 3·14 of an English inch), divided the muscles by means of a T incision so as to reach the intestine more easily. The method of Callinsen is difficult and the results it has afforded are uot encouraging; out of five operations only two were successful, this explains why, in the various discussions which have taken place of late years, and especially in 1862 at the Société de Chirurgie no member defended this method. The discussion has always been in favour of Littre's method or the operation through the perineum.

PLANCHE L.



LIBRAIRIE GERMER BAILLIÈRE

PLATE L.

Antero-lateral Region of the Abdomen.

Superficial layer.

EXPLANATION.

RIGHT SIDE (1*st layer*).

- **A.** Section of the skin bounding the region.
- **B.** Section of the superficial fascia.
- **C.** Section of the deep fascia.
- **D.** Anterior superior spine of the ilium.
- **E.** Ziphoid appendix covered by the superior extremity of the linea alba.
- **HE′.** Aponeurosis covering the rectus abdominis muscle.
- **F.** Muscular fibres of the obliquus externus abdominis.
- **F′.** Aponeurotic fibres or tendon of the obliquus externus abdominis muscle.
- **HF″.** Section of the superficial aponeurosis of the obliquus externus abdominis muscle.
- **G.** The linea alba of the abdomen, with openings for the passage of vessels and nerves.
- **H.** Fibrous cord surrounded by the fibres of the umbilicus.
- **I.** Line marking the insertion of the obliquus externus into the anterior aponeurosis of the rectus abdominis muscle: this might be termed the right external white line.
- **J.** First superior fibrous intersection of the rectus abdominis muscle.
- **J′.** Second fibrous intersection of the rectus abdominis muscle.
- **J″.** Third fibrous intersection of the rectus abdominis muscle.
- **J‴.** Fourth fibrous intersection of the rectus abdominis muscle, of which the direction is more oblique than the preceding.
- **K.** Arciform fibres continuous in the median line with those of the left side.
- **L.** Suspensory ligament of the penis.
- **1.** Superficial branches of the intercostal arteries anastomosing with the epigastric and internal mammary arteries.
- **2, 3.** Superficial ramifications of the epigastric arteries.
- **4.** Section of the artery and vein of the abdominal integument.
- **5.** Section of one of the terminal branches of the external pudic artery.
- **6, 7.** Terminal filament of the first pair of lumbar nerves.

LEFT SIDE (2*nd layer*.)

- **A.** Section of the skin bounding the region.
- **B.** Section of the superficial fascia.
- **C.** Section of the deep fascia of the groin.
- **D.** Anterior superior spine of the ilium.
- **E.** Costal margin, into which is inserted the rectus abdominis muscle.
- **F.** Section of the obliquus externus muscle.
- **F′.** Section of the superficial aponeurotic layer of the rectus abdominis muscle.
- **F″.** Section of the deep aponeurotic layer of the rectus abdominis muscle.
- **F‴.** Aponeurotic tendon of the obliquus externus abdominis muscle formed by the union of the superficial and deep layers which a little lower down form the sheath of the muscle.
- **F⁗.** Aponeurotic tendon of the obliquus externus going to be inserted into Poupart's ligament.
- **G.** Obliquus internus abdominis muscle.
- **G′.** Section of the aponeurotic fold covering the superficial surface of the obliquus internus muscle, and separating it from the obliquus externus.
- **G″.** Section of the aponeurotic tendon of the obliquus internus, united above and below to the aponeurotic insertion of the obliquus externus, to form the anterior layer of the sheath of the rectus abdominis muscle.
- **H** Section of the anterior layer of the sheath of the rectus abdominis muscle.
- **I.** Rectus abdominis muscle.
- **I′.** First fibrous intersection of the rectus abdominis muscle.
- **I″.** Second fibrous intersection of the rectus abdominis muscle.
- **I‴.** Third fibrous intersection of the rectus abdominis muscle.
- **I⁗.** Fourth fibrous intersection of the rectus abdominis muscle.
- **J.** Pyramidalis muscle.
- **1.** Artery and vein of the abdominal integument.
- **2.** Pubic artery and vein coming from the external pudic.
- **3.** Middle perforating arterial and nervous branches.
- **4.** Middle perforating arterial and nervous branches.
- **5, 6, 7, 8.** Anastamoses of the intercostal arteries with the epigastric and internal mammary arteries.
- **9.** Perforating branch of nerve coming from the last pair of intercostal nerves.
- **10.** Branch coming from the first pair of lumbar nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds although they do not penetrate the abdomen may vary in depth and so include one or more of the several layers which constitute the abdominal parietes. When the skin only is involved, the wound presents no special peculiarity, it passes through the same conditions as in other parts, and must be treated by similar means. Leeching or cupping is frequently applied as a therapeutic agent to the skin of the abdomen; as for instance in inflammation of the abdominal viscera. The wounds which ensue from these operations quickly heal up and in most cases without any complication. As this portion of the integument is very vascular, we sometimes find these wounds, as in other parts, yielding too much blood. These slight hæmorrhages are easily arrested by the application of astringent powders, of amadou, or by the use of the *serrefines*.

Fatal lesions of the skin of the abdomen are rare, yet we here meet with the spots and petechiæ of typhus fever and of Werlof's disease—purpura hæmorrhagica. It is curious to find that the pustules of small pox and of erysipelas are not so readily developed here as in other parts.

Flexible, extensible, and elastic, this portion of the skin easily yields to the developement of the uterus, of ovarian cysts, of ascites, &c. When, however, the distention is too great it does not recover its original condition, and hence there arise folds, creases, and especially scars as seen in the female after pregnancy. When the distention ceases, it is followed by a suppleness which enables us to explore more easily the viscera of the abdomen. It is this suppleness, which exists even before the distention, that explains why blows on the abdomen from projectiles or other agents, may seriously injure the deep seated viscera and yet leave no traces of violence upon the skin. The surgeon must therefore be careful not to be misled after injuries of this kind.

Wounds which involve the subcutaneous cellular tissue and the superficial layer of the aponeurosis behave in the same way as wounds that are confined to the skin and should be treated upon the same principles. Wounds situated externally do not cause hæmorrhage, because at this part there are no vessels capable of furnishing a large quantity of blood. Those, however, which occur opposite the rectus muscles may be complicated with the loss of blood in consequence of the presence of the perforating arteries which are of considerable size, and come from the intercostal, lumbar, epigastric and internal mammary arteries. Below and at the central part of the region the arteries and veins of the integument may give rise to a hæmorrhage which is easily arrested by the proper remedies.

Wounds which involve the linea alba and the sheath of the rectus abdominis muscle are not more serious than others. Those of the sheath of the rectus muscle present this peculiarity that the muscular fibres escape through the opening and so prevent the edges of the wound from uniting. In one case that I treated some years ago in the Hôpital de la Pitié, the wound was oblique, commencing a little below the umbilicus it passed outwards and downwards to the extent of about six centimetres (2·36 English inch); the retraction of the skin was very considerable, so that the sheath of the muscle was easily seen; it was moreover a penetrating wound. I applied a deep suture and a cutaneous suture, passing the sutures through the aponeurosis of the rectus muscle, and thus obtaining a purchase I should not have done had I only made use of the muscular fibres that protruded through the opening.

The situation of the inflammations and suppurations which occur in this region is determined by the anatomical layers. We may therefore meet with inflammation and abscesses; 1st. In the skin; 2nd. In the subcutaneous cellular tissue; 3rd. Between the layers of the superficial fascia; 4th. In the sheath of the rectus abdominis muscle and in that of the obliquus externus muscle; 5th. Between the obliquus externus and internus muscles. Inflammation and suppuration of the sheath of the rectus abdominis alone presents certain special characters, such as acute pain, a tendency to spread, difficulty of diagnosis, and sometimes a fatal termination, inasmuch as the pus may make its way towards peritoneum. Most frequently, however, the inflammation and the pus reach the subcutaneous layers through the openings which give passage to the perforating vessels and nerves, when this happens the nature of the inflammation can be more readily detected. A character common to all these intermuscular inflammations is their tendency to become diffuse, and to spread over a large surface; we should therefore only wait until the abscess is fully formed to open it. It is also important to remark that these abscesses contain an extremely fetid pus, having a stercoraceous odour, M. Velpeau accounts for this character by gas passing from the intestine into the cavity of the abscess.

Tumours of various kinds may occur in the abdominal parietes; the principle are: lipoma, glandular tumours, cancer, enlarged veins, and hernias. It is not uncommon to meet with a varicose condition of the superficial veins of the abdomen, a circumstance which is explained by the difficulty which the column of blood encounters in passing into the saphena vein just as it is about to join the femoral. This column of blood is met at a right angle by that of the saphena which is much the strongest. When either the right or left of these veins is in a varicose condition, the lower part of the abdomen is covered with serpentine nodular masses of veins. Sometimes these veins are uniformly dilated to give passage to the blood from the lower extremities which is prevented from traversing the inferior vena cava from its being compressed or obstructed by a tumour.

Beneath the skin of the abdomen are a number of lymphatic glands which accompany the superficial vessels of the region, they are very small and irregularly distributed. In some cases they become engorged and appear beneath the skin as small tumours which may acquire the size of an almond: it would be difficult to determine the nature of these growths if we were not aware of the presence of lymphatic glands in the part.

Lipoma of the abdomen is not uncommon. In 1850 we saw, under the care of M. Velpeau, a very large lipoma of the hypogastric region in an old man, who moreover possessed considerable stoutness of body. We also saw at that period, and under the same surgeon, an ill-defined lipoma in a female occupying the lateral region of the abdomen.

Cancer of the abdominal parietes is very rare, but when present, it shows itself at the umbilicus rather than at any other part. Boyer has described it under the name of *Sarcomphale.* We are indebted to Fabrice de Hilden, to Civadier, and to Bérard for the three cases which are known of this disease. We have seen one case under the care of M. Nélaton in 1859. These tumours present themselves under two forms, sometimes resembling a mushroom projecting from the umbilical cicatrix, and provided with a longer or shorter pedicle; at other times they form a mass which is confounded with the umbilicus, and presents no distinct projection. In both cases the tumour, as we have seen, may extend over the parietes following the course of the umbilical arteries, and thereby rendering extirpation impossible.

In the infant, after the separation of the cord, a pinkish-coloured, fungus-like tumour may make its appearance at the umbilicus, as has been already pointed out by Dugès, and may acquire the size of a nut. This excrescence is easily destroyed by cauterising it with the nitrate of silver when it is small, but when larger, it should be ligatured or excised with the scissors.

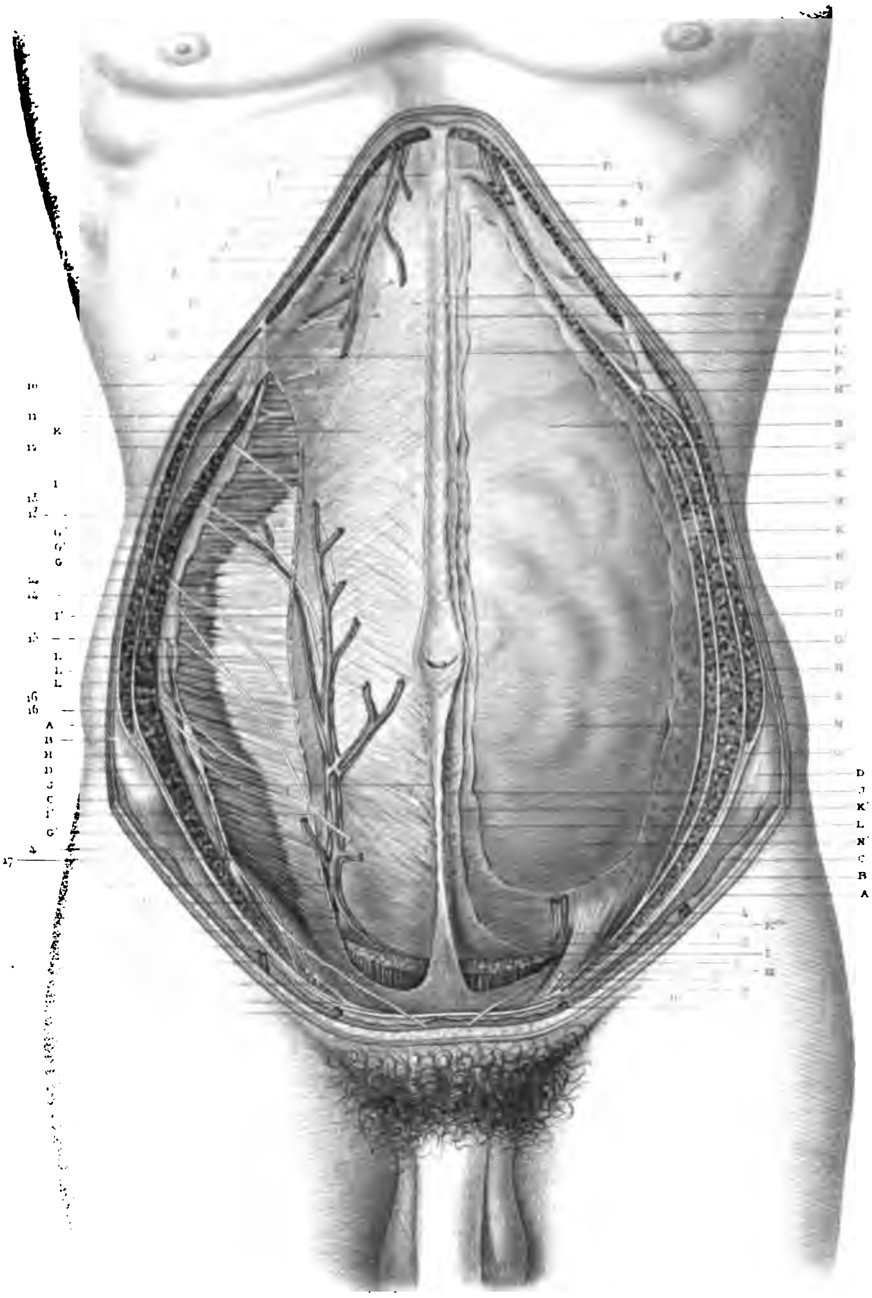
Hæmorrhage sometimes occurs at the umbilicus after the separation of the cord. This hæmorrhage, which may come from the umbilical vein or arteries, in most cases is easily arrested; but when it is due to an alteration in the liver, or in the blood, it is often fatal.

Hernia of the abdominal parietes often occurs in the course of the linea alba, and principally at the umbilicus. The separation of the linea alba, arising from the distention of pregnancy, favours the formation of hernia at the lower part of the linea alba in the sub-umbilical region. These protrusions should be treated by means of a bandage round the body.

Hernia of the umbilicus may be congenital or acquired; the latter is divided into those that occur in the infant, and into those which happen in the adult; their mode of formation bears a strong analogy to that of inguinal hernia, as has been shown by M. Richet.

With hernias may be associated the tumours or fatty hernias which occupy most frequently the neighbourhood of the umbilicus, they occur in the course of the vessels which traverse the linea alba; it is important to distinguish them from true hernias.

Preternatural anus, stercoracious, urinary, purulent, and gaseous fistulæ also occur in the parietes of the abdomen.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LI.

Antero-Lateral Region of the Abdomen.

Deep Layer.

EXPLANATION.

RIGHT SIDE *(third layer).*

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Section of the deep fascia of the inguinal region.
D. Anterior and superior spine of the illium.
E. Ziphoid appendix covered by the aponeurosis of the transversalis muscle.
F. Margin of the costal cartilages.
G. Section of the obliquus externus abdominis muscle.
G′. Aponeurotic tendon of the obliquus externus going to be inserted into Poupart's ligament.
G″. Superficial aponeurosis of the obliquus externus muscle.
G‴. Deep aponeurosis of the obliquus externus muscle.
H. Section of the obliquus internus abdominis muscle.
H′. Section of the aponeurotic insertion of the obliquus internus muscle passing to unite with the aponeurotic insertion of the obliquus externus muscle.
I. Section of the rectus abdominis muscle.
I.′ Section of the superficial aponeurosis of the rectus abdominis; this aponeurosis is formed by the interlacing and union of the aponeurotic fibres which separate the transverse and obliquus internus muscles.
J. Section of the superficial layer of the sheath of the rectus abdominis interlacing with those of the opposite side to form the linea alba.
K. Posterior layer of the aponeurotic sheath of the rectus abdominis muscle.
K′. Posterior layer of the sheath of the rectus abdominis formed by serrated aponeurotic fibres and covered behind and at its lower part by the fascia transversalis.
L. Transverse muscle of the abdomen.
L′. Aponeurotic fibres of the transverse muscle.
L″. Superficial aponeurosis of the transverse muscle.
M. Fibres of the transverse muscle accompanying the spermatic cord.

1. Mammary artery with its ramifications and their accompanying veins.
2. Epigastric artery accompanied by the veins of the same name.
3. Transverse branch of the epigastric artery going to the obliquus externus abdominis muscle.
4. Circumflex branch of the external iliac artery.
5. Artery of the abdominal integument with its accompanying vein.
6. Pubic artery, a branch of the external pudic, with the vein of the same name.
7, 8, 9, 10, 11, 12, 13, 14, 15, 16. Perforating branches of the intercostal nerves.
17. Branch of the great abdominal nerve.

LEFT SIDE *(fourth layer).*

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Section of the deep fascia of the groin.
D. Anterior superior spine of the ilium.
E. Ziphoid appendix covered by the aponeurosis of the transverse muscle.
F. Margin of the false ribs.
F′. Posterior sheath of the rectus abdominis muscle.
G. Section of the obliquus externus muscle.
G′. Superficial aponeurosis of the rectus abdominis muscle.
G″. Deep layer of the rectus abdominis separating this muscle from the obliquus internus muscle.
G‴. Aponeurotic layer produced by the union of the superficial and deep aponeuroses of the rectus abdominis and going to be inserted into Poupart's ligament.
H. Section of the obliquus internus muscle.
H′. Aponeurotic layer separating the obliquus internus and transverse muscles.
H″. Fibrous or aponeurotic membrane serving for the insertion of the obliquus internus and passing to the last ribs.
H‴. Fibrous membrane arising from the union of the superficial and deep aponeurosis of the obliquus internus muscle and going to be united with the aponeurosis of insertion of the obliquus externus.
I. Section of the rectus abdominis muscle.
I′. Section of the superficial layer of the sheath of the rectus abdominis muscle.
J. Section of the linea alba of the abdomen.
K. Section of the transversalis abdominis muscle.
K′. Deep layer of the aponeurosis of the transverse muscle of the abdomen becoming united with the aponeurosis of the obliquus internus muscle.
K″. Section of the posterior fibrous layer of the sheath of the rectus abdominis muscle.
K‴. Section of the posterior fibrous layer of the sheath of the rectus abdominis muscle below the umbilicus, where it is not so thick.
K⁗. Aponeurosis formed by the union of the aponeurosis of the obliquus internus and transverse muscles going to cover the aponeurotic insertion of the obliquus externus.
L. Section of the fascia transversalis.
L′. Fibrous membrane covering the peritoneum and continuous with the fascia transversalis.
M. Fibrous prolongation of the fascia transversalis forming the fibrous sheath of the spermatic cord.
N. The peritoneum through which may be seen the folds of the intestines.
N′. Peritoneum covered by a cellular membrane which separates it from the fascia transversalis.

1. Section of the internal mammary artery and the veins of the same name.
2. Epigastric artery and its veins.
3. Internal branch of the epigastric artery going to the lower portion of the rectus abdominis muscle.
4. Arteries and veins of the abdominal integument.
5. Pubic artery furnished by the external pudic.
6, 7. Filaments of nerves coming from the first pair of lumbar nerves (great abdominal nerve).

Wounds which extend to the deep layers of the anterior parietes of the abdomen are more dangerous than those which only involve the superficial layers. Here, in fact, the instrument which inflicts the wound may come in contact with vessels and nerves of considerable importance. At the outer part of the region are the intercostal and lumbar arteries, passing transversely and obliquely from above downwards, and from behind forwards. It follows from this arrangement that incisions of the part should be made parallel to the course of these vessels if we wish to avoid their division. At about 6 centimetres (2·36 English inch) external to the linea alba is the epigastric artery lodged in the sheath of the rectus abdominis muscle. This artery passes nearly parallel to the linea alba; and hence the reason for making our incisions at this part in a vertical direction. In operations on the abdomen we should always endeavour to avoid wounding the epigastric artery, in consequence of the hæmorrhage which ensues, and which is always difficult to arrest, on account of the depth at which the vessel is placed. In performing paracentesis for ascites, or for an ovarian cyst, or in performing gastrotomy, the operation should always be done at a distance from this vessel. Upon this is founded the principles which have been laid down for the performance of these operations. Thus in ascites the puncture may be made according to the English method, opposite the linea alba below the umbilicus, or according to the French method, by puncturing in the centre of a line drawn from the anterior superior spine of the ilium on the left side to the umbilicus. The centre of this line corresponds to the point external to the rectus muscle where there are only vessels of the third magnitude, and whose division is not attended with any danger. If the English method is adopted, the opening must not be made too low in order to avoid the bladder distended by the urine. The Cæsarian section should be made in the median line after having emptied the bladder. We are thus sure to avoid wounding the epigastric artery, while with a transverse or oblique incision made at the side, we are far from being safe against this accident. Wounding the epigastric artery is not however necessarily fatal, the bleeding may stop spontaneously as we witnessed in the case of a man who had been stabbed with a knife in the abdomen. If the artery is wounded in operating, both ends should be secured in consequence of its numerous anastomoses.

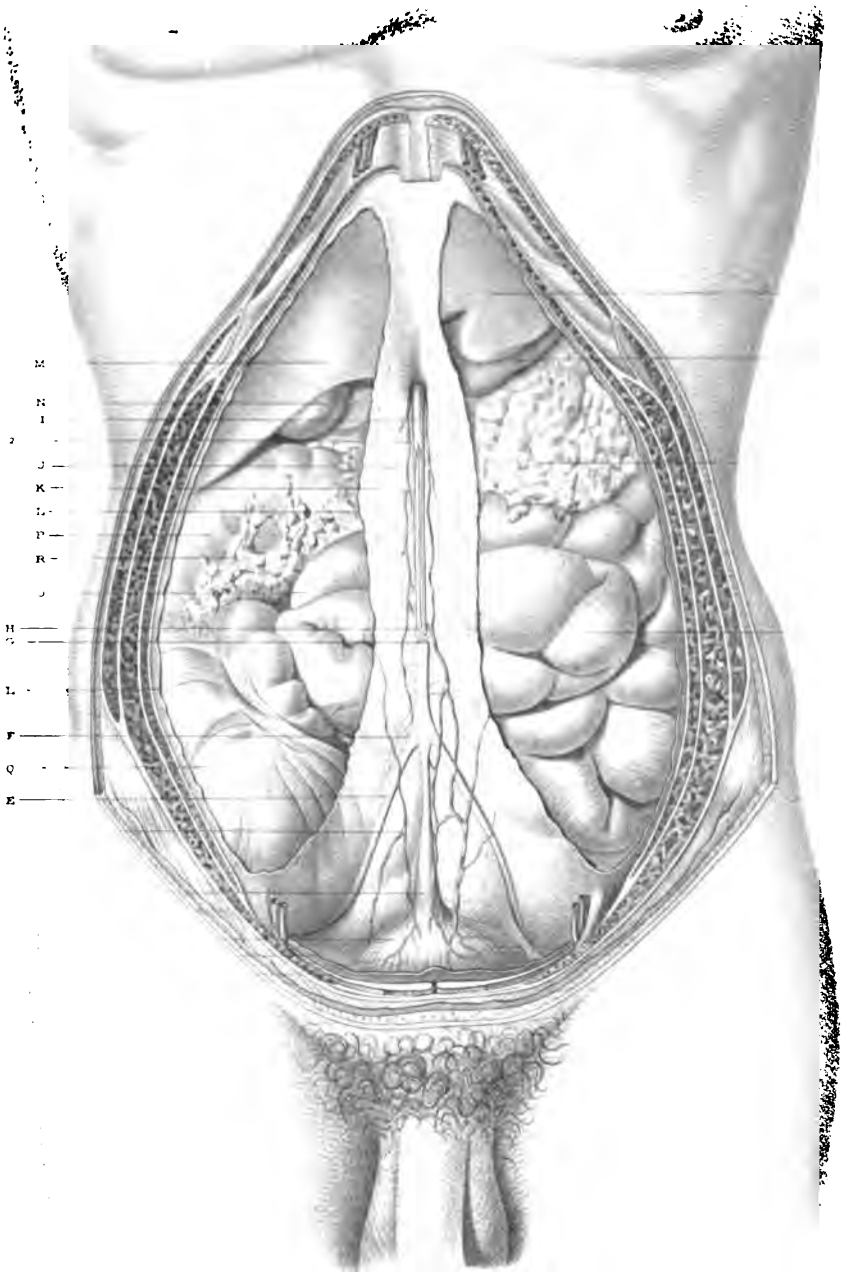
Wounds of the anterior parietes of the abdomen are dangerous in proportion to their depth, inasmuch as they diminish the resistance of the part and so favour the production of hernia; in fact the cicatrix which ensues, offers less resistance than the corresponding part which has not been injured. It is scarcely necessary to observe that this complication is more likely to occur the more extensive the wound, the deeper it penetrates and the lower down it is situated. We say the lower down it is, because it is there that the weight of the abdominal viscera falls. For the same reason where it is necessary to extend the wound, surgeons have laid down the rule that it should be done at its upper part.

In making an oblique incision in the median line as is sometimes done in ovariotomy, we should bear in mind the small artery which comes from the epigastric artery and enters the rectus muscle. In order to avoid wounding it, it is advisable not to operate too far from the median line.

In applying a ligature to the common iliac artery or to either of the two branches into which it divides, the parietes of the abdomen are necessarily divided. In making these incisions, we must take into consideration the situation of the epigastric artery as well as the relations of the peritoneum to the walls of the abdomen. With regard to the artery, the incision should be made external to it, its centre corresponding to the spine of the ilium and its anterior extremity not passing beyond a line perpendicular to Poupart's ligament. With respect to the peritoneum, which should be separated and not opened, it yields more easily opposite to this incision than opposite the rectus abdominis muscle. In fact, the nearer we get to the linea alba, the more firmly this membrane adheres—while, on the contrary, its adhesions are weaker the nearer we approach to the iliac fossa. Considered in these two points of view, the curvilinear or rectilinear incision which we have advised in applying a ligature to the iliac arteries is to be preferred to any other, especially to one directed obliquely from above downwards following the course and direction of these vessels, such an incision would be sure to come across the epigastric artery and veins, and reach a part where the peritoneum is very difficult to separate.

Flexible and tolerably thin the abdominal parietes are often distended by the various tumours which originate in the abdominal cavity, or in one or other of its viscera; it thus enables us to make an exploration which is absolutely indispensable to form our diagnosis, it is, for instance, in this way that we detect the fluctuation of ascites, or of a cyst. Unfortunately this is not always the case, the parietes may become greatly thickened, as in persons who are stout, and if we auscultate under these conditions it is difficult to detect the sounds of the heart of the fœtus in the pregnant woman; under other circumstances the difficulty of diagnosis depends upon the presence of serous infiltration, or upon extreme tension of the part.

Tumours also originate in the parietes of the abdomen; we have already mentioned lipomas, varicose veins, hernias and cancers, but these are not all. M. M'Farlane succeeded in removing an hydated cyst from the iliac region and could detect two similar cysts in the same part. At the present time we have under our care an elderly lady with a tumour in the right iliac region, it has produced considerable enlargement and a tortuous knotted condition of the subcutaneous veins, it has a lobulated irregular form which can be easily felt, leading us to regard it as an hydated tumour. What confirms us in our diagnosis, is that under our treatment we have detected membranous, yellowish, translucid and very characteristic cysts in the stools, and at the same time when these vescicles came away the size of the tumour was diminished and the health of the patient improved. M. M'Farlane has seen death occur five days after puncturing a cyst situated between the muscles and the peritoneum. In a case where he was compelled to remove the extremities of the two last ribs, with a fibro-cartilaginous tumour developed between the muscles, this surgeon had also to deplore the loss of the patient thirty-one hours after the operation from peritonitis. A cyst containing a pulpy substance similar to that of the testicle and communicating with the peritoneum, nevertheless permitted the recovery of the patient in a case mentioned by M. Basletta. It was the same with regard to one referred to by M. Dufau and which was ruptured in making some muscular effort. M. Monod showed M. Velpeau a neuromatous and atheromatous mass the size of the fist which he had successfully removed from between the muscles of the abdomen. In all these cases we recommend, with M. Velpeau, to avoid injuring the peritoneum.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LII.

Cavity of the Abdomen.

Superficial Layer.

EXPLANATION.

RIGHT SIDE.

A. Section of the tendon of the rectus abdominis muscle.
B. Section of the fascia transversalis.
C. Vertical muscular fibres of the bladder.
D. The urachus.
E. Umbilical artery and fibrous cord continued to the umbilicus.
F. Fibrous cord resulting from the union of the urachus and the obliterated umbilical arteries.
G. Section of the fibrous cord opposite the umbilical ring.
H. Section of the remains of the umbilical vein going to the liver.
I. Union of two fibrous bands forming a single cord not pervious in the adult.
J. Section of the first membrane forming the posterior wall of the umbilical canal whose surface is smooth and shining.
K. Section of the second membrane with transverse nacreous fibres forming the posterior wall of the umbilical canal.
L. Section of the peritoneum forming the third membrane of the posterior wall of the umbilical canal.
M. Convex surface of the right lobe of the liver.
N. Apex of the gall bladder.
O. Anterior fold of the small intestine.
P. Union of the ascending and transverse colon.
Q. Cœcum.
R. The great omentum in the left hypochondrium.

1, 2. Veins passing from the bladder; anastomosing with each other, and accompanying the urachus and the remains of the umbilical vein to enter the liver.

LEFT SIDE.

A. The greater curvature of the stomach.
B. The small intestine.
C. The omentum.
D. The left lobe of the liver.

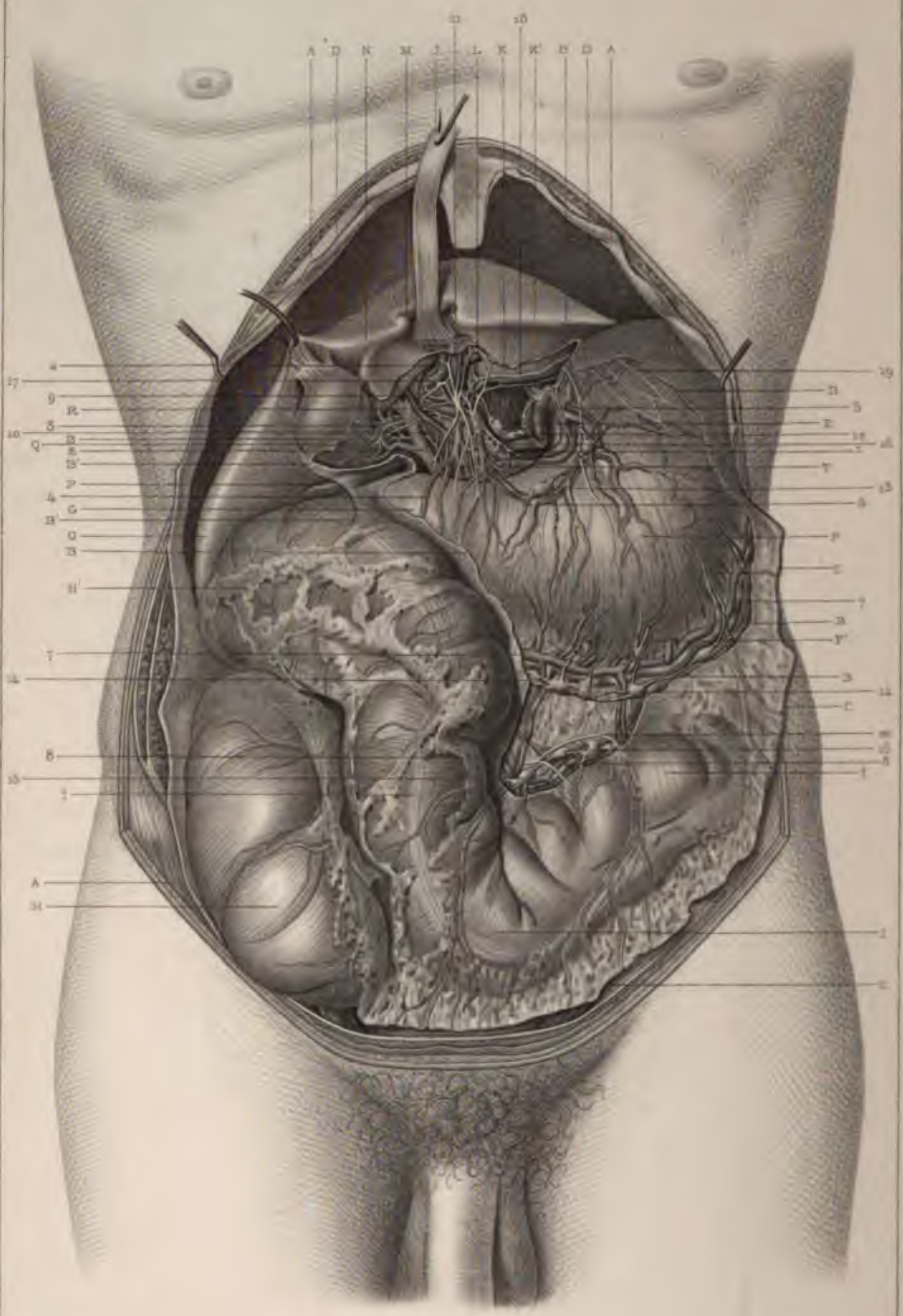
APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Penetrating wounds of the abdomen are extremely dangerous, in consequence of their affecting one or more of the organs essential to life. The present plate shows the superficial organs which are the first that are liable to be wounded. These are the parietal and visceral layers of the peritoneum, the upper part of the bladder, the omentum, a portion of the large and small intestines, the liver and the stomach. Let us rapidly examine what are the symptoms presented by wounds of these organs.

Wounds of the parietal layer of the peritoneum are generally dangerous, because they open the peritoneal cavity, and are sometimes followed by peritonitis, especially if any foreign substance, such as a bullet or part of a weapon, remains in the wound. Nevertheless, we think that the danger of these wounds has been somewhat exaggerated, inasmuch as we constantly see wounds of the peritoneum which are not complicated with peritonitis. How often is a hernial sac opened, or the operation for artificial anus performed, without the slightest disturbance. In strangulated hernia, in gastrotomy, or in any other operation in which the peritoneum is opened, peritonitis rarely occurs, unless the disease has commenced before the performance of the operation. This is a strong reason for operating early. It is in order to avoid this inflammation, which rapidly extends over a large surface, that it has been recommended to obtain adhesion between the two layers of the peritoneum when we wish to reach an abdominal tumour. It is upon this principle that the operations proposed by Récamier, Trousseau, and Bégin in cases of cysts of the liver, or of the ovary are founded. The principle, so to speak, is inculcated by nature herself, who often spontaneously establishes adhesions between two adjoining surfaces of the peritoneum for the purpose of circumscribing an inflammation, or a discharge or collection of purulent matter; this is what happens in partial peritonitis, in pelvic peritonitis, and in artificial anus. The surgeon should watch for the formation of these adhesions, and carefully preserve them when they are established.

An examination of the plate shows that after the peritoneum, it is the upper part of the bladder which is exposed to injury from a penetrating instrument. In the adult, the anterior surface of this cavity is protected by the symphysis pubis; but the half or the superior third of it is in contact with the posterior surface of the abdominal parietes without being covered by the peritoneum. The surgeon has availed himself of this disposition of the parts in performing the high operation for stone. An incision in the median line above the pubis exposes the bladder at a part where there are no vessels of importance, and where it is not covered by the peritoneum. Nevertheless, this operation has sometimes given rise to inflammation of the peritoneum, which has proved rapidly fatal. M. Malgaigne supposes that in these cases the peritoneum is so arranged as to cover the anterior surface of the bladder, and that consequently it is reached by the knife; to avoid this accident, the *cul de sac* of the peritoneum must be raised up before opening the bladder. Fortunately this arrangement is not constant, and it was not so in the subject from which the drawing was made. Wounds of the bladder may be inflicted by pointed, cutting, or blunt instruments; wounds inflicted by fire arms are amongst the latter; they may or may not involve the peritoneum; their history has lately been well illustrated in an excellent monograph by M. Houel, which may be consulted with advantage. The danger attending these injuries arises from infiltration of the urine, which takes place very readily, in consequence of the lax condition of the cellular tissue of the region.

In the adult, the omentum occupies the first layer of the abdominal organs; sometimes it covers the entire mass of the viscera, in front of which it hangs down like a curtain; at other times it is confined to the epigastric region, as in the present drawing. In new born infants and in young children, the great omentum is in a rudimentary state, and it is therefore rare to meet with an omental hernia at these periods, while in adults the fold of the peritoneum must almost necessarily form part of a hernia. It follows from this arrangement of the parts that in penetrating wounds of the abdomen, when they are situated on the anterior surface, the first structure seen at the orifice of the wound is the omentum, and, moreover, it is the first which is reached by injuries of this kind. In consequence of the size and



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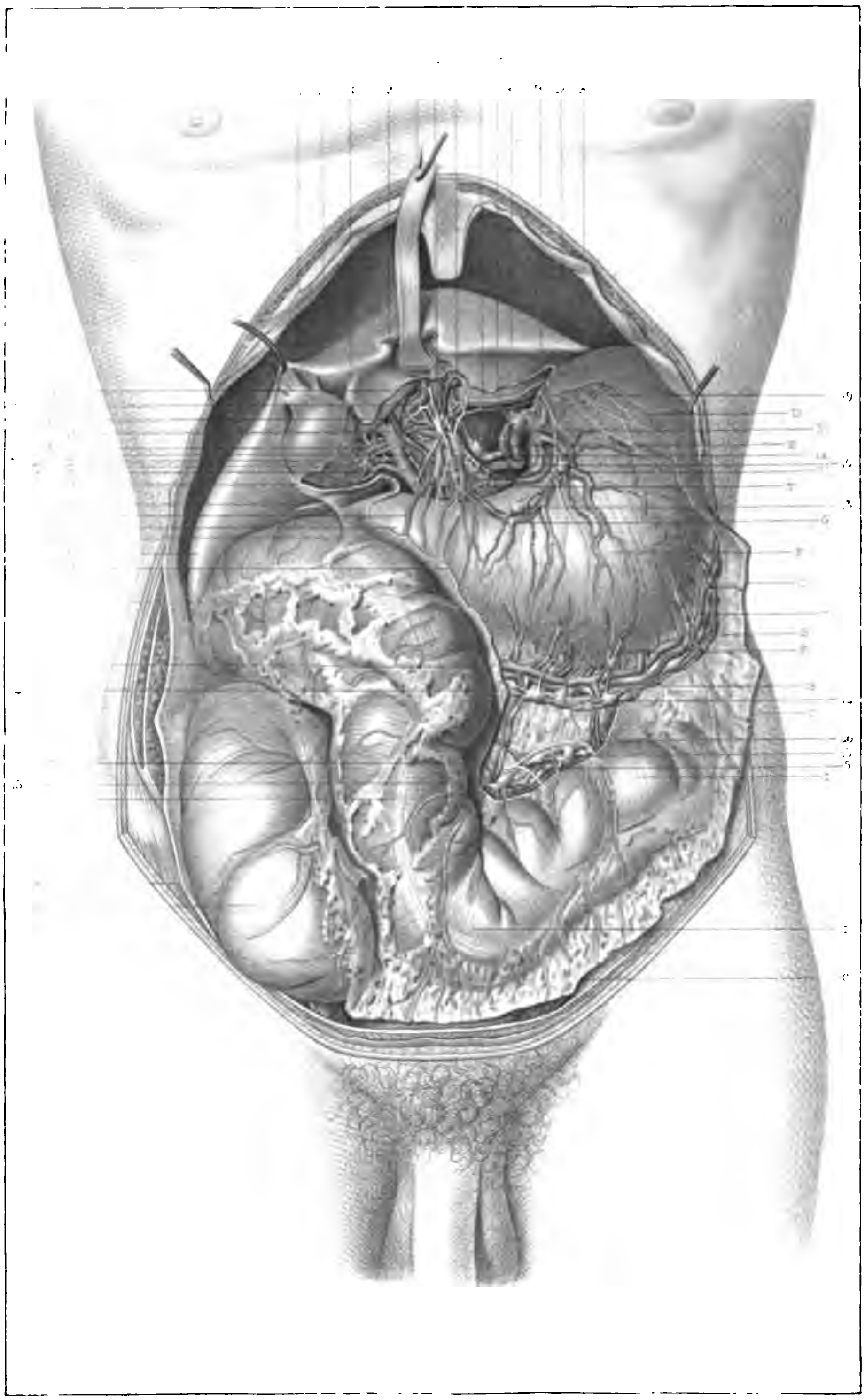


PLATE LIII.

Cavity of the Abdomen.

Middle layer.

EXPLANATION.

A. Section of the parietal peritoneum.
B. Section of the visceral peritoneum.
B′. Free margin of the fold of the peritoneum uniting the gall bladder, the transverse colon and the pylorus.
C. Section of the great omentum.
D. Peritoneum covering the concavity of the diaphragm.
E. Pillar of the diaphragm.
F. Anterior superior surface of the stomach.
G. The pylorus.
H. The cœcum.
H′. The ascending colon.
I. The transverse colon.
J. Suspensory ligament of the liver.
K. Left lobe of the liver divested of its peritoneum.
K′. Line forming the boundary between the convex and concave surfaces of the left lobe of the liver.
L. The lobus Spigelii, imperfectly seen on account of the divisions of the vena portæ and of the nerves which are found on its anterior surface.
M. Longitudinal groove of the liver.
N. Margin forming the boundary between the concave and convex surfaces of the right lobe of the liver.
O. Inferior extremity of the anterior margin of the liver.
P. Fissure situated on the concave surface of the liver.
Q. Gall bladder partly deprived of its peritoneal covering.
R. Union of the biliary ducts forming the hepatic duct.
S. Anastomosis of the cystic duct with the hepatic duct forming the ductus communis choledocus.
T. Superior margin of the body of the pancreas.

1. Hepatic artery.
2. Branch of the hepatic artery going to the left lobe of the liver.
3. Branch of the hepatic artery furnishing the right lobe of the liver with the cystic artery.
4. Ramifications of the pyloric artery.
5. Gastric artery.
6. Anastomosis of the pyloric artery with the gastric.
7. Gastro-epiploic artery furnished in this preparation by the superior mesenteric artery.
8. Ramifications of the right gastro-epiploic artery going to the transverse colon and to the omentum.
9. Pyloric vein passing to the liver.
10. Right margin of the Portal vein three parts covered by the other vessels and nerves.
11. Branch of the Portal vein going to the left lobe of the liver.
12. One of the lymphatic glands and vessels accompanying the hepatic artery.
13. One of the lymphatic glands and vessels situated on the lesser curvature of the stomach.
14. Two of the glands and lymphatic vessels following the course of the greater curvature of the stomach.
15. Lymphatic vessels and glands of part of the transverse colon.
16. Plexus of nerves accompanying the hepatic artery and forming several nervous ganglia in the course of the artery.
17. Ramifications of nerves accompanying the branches of the hepatic artery.
18. One of two nervous branches forming a communication between the hepatic plexus of nerves and the pneumogastric nerve.
16. Ramifications of the right pneumogastric on the stomach.
20. Nerve furnished by the superior mesenteric plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

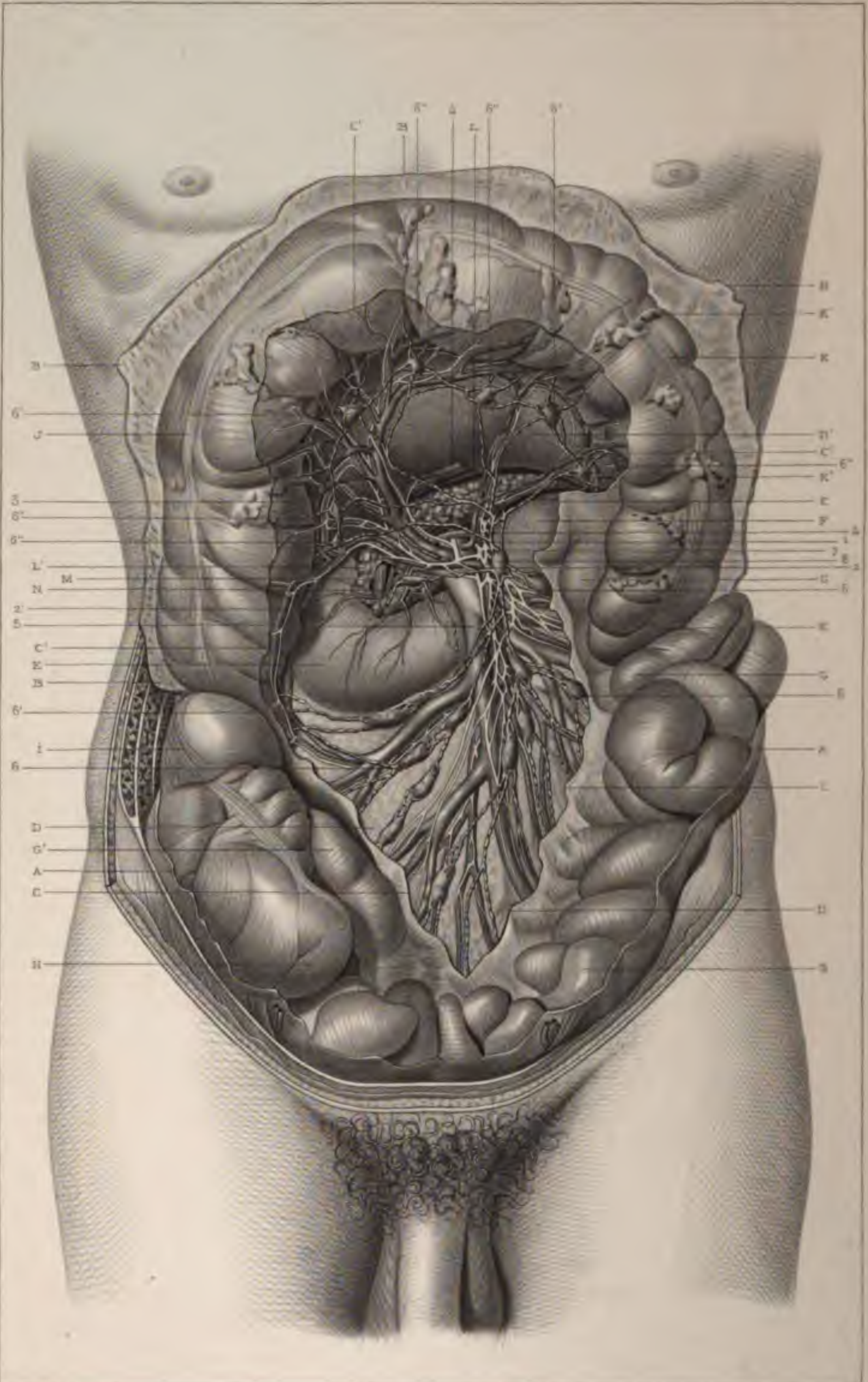
In this plate the transverse colon is seen forming a curve with the concavity directed upwards and covering the whole of the small intestines; in such a case a penetrating wound of the abdomen in the umbilical or hypogastric region would injure the large intestine before the small. For this reason it is impossible to diagnose the exact situation of a wound of the intestine from the position of the external wound; the characters of the discharge from the wound will frequently afford more exact data. The gastro-epiploic vessels are here exposed during a part of their course, and it is evident from their size and numbers that a wound of the omentum may easily be attended with severe hæmorrhage. It is the same with regard to wounds of the stomach; this organ presents along its two curves, and also on its anterior surface, a numerous series of large arteries and veins, which if wounded, must give rise to a considerable hæmorrhage, or to a hæmorrhage of the stomach, which would be speedily fatal.

Wounds of the stomach may heal spontaneously, or by medical treatment and then they sometimes leave a gastric fistula, which must be treated by appropriate means.

This plate also shows that the stomach is only retained in its position by slight and extensible attachments, so that nothing is more common than for this organ to be misplaced. This is especially the case with the pyloric extremity, which is carried downwards towards the hypogastric region; for this reason, a tumour situated above the pubis may possibly be a cancer of the pylorus. Less frequently it is the great curvature which becomes distended or depressed so as to reach the hypogastric region, as was seen by Valsalva. Lastly, the entire stomach sometimes occupies the middle or even the inferior portion of the abdomen; this displacement is necessarily accompanied by a proportionate elongation of the œsophagus. Situated normally below the diaphragm, the displaced stomach easily enters the thorax through a congenital or accidental opening in this muscle.

The situation of the stomach explains why in cases of hernia this organ presents itself in the umbilical region, or in the hollow of the epigastrium; but, in consequence of the facility with which it is displaced, it may also be met with in any of the hernias which pass through the rings situated at the lower part of the abdomen.

Foreign substances of every kind and size have been found in the stomach. When these bodies do not pass into the intestines they produce irritation of the stomach; and hence arises a cause, either of death or of cure: of death if it produces peritonitis or causes hæmorrhage by perforating one of the vessels; of cure if it produces adhesions between the corresponding surfaces of the peritoneum, or if an abscess forms and opens a passage for the foreign body through the parietes of the abdomen.



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epithelium, of pediculated subserous cysts, of a kind of fibrous tumour, or of coagulated fibrine the remains of effused blood. The latter bodies undergo various modifications, thus they may become hard, cretified, converted into bone, or into cartilage; they seldom give rise to any serious disturbance.

The distended peritoneum presents a number of minute depressions having the appearance of follicles. In some researches which I undertook in 1848, when assistant anatomist to the Faculty of Medicine, I proved that after delivery, the utero-rectal and utero-vesical peritoneal cul de sacs presented a very large number of these minute depressions. I believed moreover that they were true follicles, and secreted during pregnancy an unctious kind of fluid intended to facilitate the movements of the surfaces over each other. However this may be, these depressions enable us to perceive the cellular tissue of the peritoneum, and explain why inflammation of this peri-uterine tissue is easily propagated to the cavity of the peritoneum.

Protected in front by rather a thin layer of soft structures, the small intestines are often perforated by cutting instruments; it should be observed that as they form several convolutions, they may be wounded several times. The large intestine, with the exception of the transverse colon, is less exposed to injuries; behind, it is protected by the vertebral column and thick layers of muscles, at the sides by the crest of the ilium and the false ribs, which are very close to each other. The arrangement of the peritoneum around certain portions of the large intestines suggests an important remark; we know that in some persons the cœcum and the two lumbar portions of the colon are not invested by the serous membrane throughout a greater or less extent of their posterior circumference; it follows that a wound at this part will not penetrate the peritoneum, and that therefore there can be no effusion into the cavity of this serous membrane; these wounds are consequently less dangerous than the others. One of two things takes place, either the matters easily make their way outwards, and then there is neither effusion or peritonitis, or the external exit is difficult, and then there is merely a discharge into, or infiltration of the cellular tissue, and a stercoraceous abscess. These wounds may heal spontaneously; when this happens they set up a local action by which coagulable lymph is deposited around the injured part; the wound thus becomes isolated, the margins swell, and union takes place; but when death does not ensue another mode of termination may take place, either the intestine may communicate with another reservoir, or one portion of it may communicate with another; an artificial anus may form, or a stercoraceous fistula may remain.

Various plans have been suggested for the purpose of healing these wounds, they consist in bringing the edges of the wound directly together, in bringing into apposition a serous and a mucous membrane, or two serous membranes. The two first plans do not offer much chance of success, while, on the contrary, the latter places the patient in a favourable condition. This method, established by M. Jobert (de Lamballe), in his *Maladies du canal intestinal*, Tome I, p. 82, Paris, 1829, consists in placing the serous surfaces of the two extremities in contact with each other. We know that serous membranes readily pour out coagulable lymph, which brings them together and ultimately unites them. This plan has produced favourable results, and is equally applicable to complete or partial wounds.

Floating as it were in the abdomen, and capable of spontaneous movements, the intestine is subject to various displacements, which may bring it to the openings of the abdomen, and give rise to hernia; or its movements may cause intussusception of one portion within another, and so modify, impede, or arrest the course of the matters passing through the canal; these conditions produce strangulation of the intestine, it has been divided into external and internal.

External strangulations are those which the surgeon can see and feel, and are produced by hernias; we shall presently explain their mode of production and their consequences.

With regard to internal strangulations they are not unfrequent: their investigation has been ably given by M. Besnier in a memoir entitled *Des étranglements internes de l'intestin*, and is well deserving of attention. Internal strangulation may be caused by several anatomical conditions, such as invagination, constriction, flexion, or twisting of the intestine. It is sometimes caused by firm bands, or by the appendix vermiformis of the cœcum; or again by the diverticular appendages of the intestine. M. Nélaton has given in his *Traité de pathologie externe* several examples of this species of obstruction. It is not unusual to meet with external strangulation of the intestines occurring where there are abnormal or accidental openings in the layers of the peritoneum, or where there are openings or perforations in the diaphragm. Occasionally the peritoneum presents diverticulæ analogous to those we have described in the tunica vaginalis; M. Huguier and M. Péan recently exhibited at the Société de Chirurgie an excellent specimen of these diverticulæ. It is not surprising that a fold of intestine should get entangled in these internal apertures, and so become strangulated, forming a variety of internal strangulation that it is necessary we should be acquainted with. Lastly, when the intestine is pressed upon by a neighbouring tumour, it can no longer allow substances to pass through it, and we shall then have symptoms of another form of strangulation which is not of uncommon occurrence.

M. Nélaton has laid down the rule that in cases of internal strangulation, an opening should be made in the right iliac fossa into the first fold of the small intestine that is found to be distended. This rule is good in regard to strangulation of the small intestine, because the opening being made above the strangulation allows of the exit of the fœcal matter; but in a case of strangulation of the large intestine, if the surgeon makes an opening into the small intestine, the operation will be useless, or at all events incomplete, because the intestinal matters accumulated in the large intestine will remain confined between a natural impediment, the ilio-cœcal valve, and a pathological impediment, the strangulation. In such a case we must satisfy ourselves that the large intestine is not distended, which is known by the anatomical characters of the large intestines as regards their immobility, and then open the canal (Besnier).

The mesentery may be in a kind of relaxed condition, in consequence of which the intestine is not properly supported, and easily presents itself opposite the natural openings, and is thus pre-disposed to hernia. Like the other viscera it may be wounded, and will then give rise to an effusion of blood in consequence of its great vascularity. It is also the seat of morbid growths, such as glandular enlargements, as occurs in tabes mesenterica, and in typhus fever. Cancer, hydatid and fibrous tumours of the mesentery are not uncommon. All these tumours possess a common character, namely, that of arresting the circulation in the mesentery and the abdomen, giving rise to serous effusions into the peritoneal cavity.

The pancreas being deeply situated is rarely wounded; when this does occur, as we saw in one of the wounded Parisians in June, 1848, other organs more essential to life lie in front of it, and the symptoms produced by them evidently obscure those which arise from the pancreas. This organ is liable but to few alterations; nevertheless fibrous, calcareous, and cancerous degenerations of the organ have been met with, more especially as following similar morbid alterations in the stomach, which is in juxta position to it.

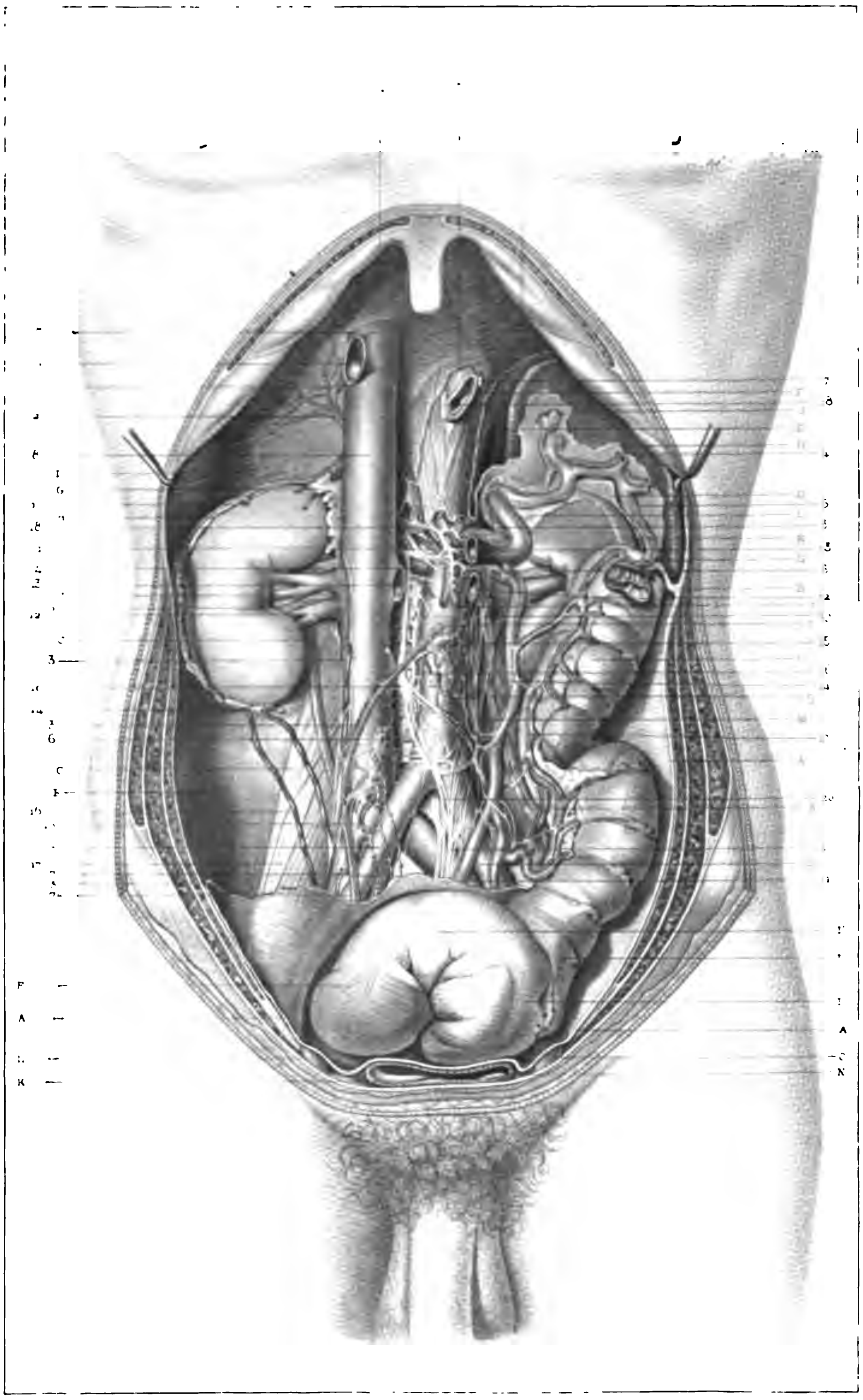
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PLATE LV.

Abdominal Region.

Posterior and Superior Parieties.

EXPLANATION.

LEFT SIDE (*superficial layer*).

A. Section of the parietal or anterior layer of the peritoneum opposite the lumbar region and the iliac fossa.
B. Section of the fold of the peritoneum dividing the abdomen into two compartments: the superior containing the spleen, and the lower the kidney and the angle of the descending colon.
C. Section of the peritoneum covering the inferior surface of the diaphragm.
D. Section of the superficial layer of the gastro-splenic omentum.
D′. Section of the deep layer of the gastro-splenic omentum (these layers are turned back and between are seen the splenic vessels and nerves).
E. The left crus of the diaphragm.
E′. Aponeurotic arch of the diaphragm beneath which the œsophagus passes, and from which the aponeurosis lining the inferior surface of the diaphragm passes off.
F. Section of the œsophagus.
G. Angle of separation between the transverse and descending colon.
H. Descending colon.
I. First portion of the sigmoid flexure of the colon.
I′. Second portion of the sigmoid flexure forming a curve.
I″. Longitudinal muscular fibres of the sigmoid flexure.
J. Spleen seen from its internal or concave surface.
K. Left kidney seen in its relation to the spleen, to the colon, and to its divided fatty investment.
L. Supra renal capsule.
M. Ureter.
N. Horizontal section of the bladder.
O. Spermatic cord.

1. Abdominal aorta.
2. Left common iliac artery.
3. The cœliac axis dividing into three branches, the hepatic, gastric, and splenic arteries. The two first have been divided, while the latter pass towards the left side of the abdomen.
4. The vasa brevia and gastro-splenic vessels.
5. Branch of the splenic artery passing to the transverse colon and establishing a communication between the superior and inferior mesenteric arteries and the splenic arteries.
6. Left renal artery on which is seen the renal plexus of the sympathetic nerve.
7. Section of the superior mesenteric artery at the point of its first sub-division.
8. Spermatic artery with the veins going to join the renal vein.
9. Inferior mesenteric artery at its origin.
10. Recurrent branch of the inferior mesenteric artery anastomosing with the splenic artery.
11. Left common iliac vein.
12. Section of the left renal vein where it passes in front of the aorta to join the inferior vena cava.
13. Section of the splenic vein.
14. Inferior mesenteric vein going to join the splenic vein.
15. Group of lymphatic glands situated in front of the aorta, receiving the lymphatic vessels coming from the descending colon and inferior extremity of the intestine.
16. The receptaculum chyli.
17. Section of the left pneumogastric nerve.
18. Section of the right pneumogastric nerve.
19. Spermatic plexus.
20. Left aortic plexus going to form the hypogastric plexus.
21. Hypogastric plexus.

RIGHT SIDE (*deep layer*).

A. Section of the peritoneum opposite the iliac fossa.
B. Tendinous arch of the diaphragm giving passage to the inferior vena cava.
C. Muscular fibres of the psoas covered by their aponeurosis.
D. Muscular fibres of the diaphragm.
E. Aponeurosis covering the anterior surface of the quadratus lumborum muscle.
F. Commencement of the rectum.
G. Supra-renal capsule.
H. Section of the fatty deposit investing the kidney.
I. Hilus of the kidney.
J. Ureter.
K. Section of the bladder.
L. Spermatic cord.

1. Right phrenic artery.
2. Ramifications of the right phrenic artery.
3. Right spermatic artery.
3′. Small supernumerary spermatic artery coming from the aorta above the renal arteries descending to anastomose with the spermatic artery (irregular).
4. Right renal artery.
5. Inferior branch of the right renal artery.
6. Last right lumbar artery.
7. Common iliac artery.
7′. Hypogastric or internal iliac artery.
7″. External iliac artery.
8. Inferior vena cava.
9. Section of the sub-hepatic vein.
10. Inferior veins of the diaphragm going to join the inferior vena cava.
11. Veins of the fatty capsule anastomosing with the veins of the supra renal capsule and going to join the inferior vena cava.
12. Inferior branch of the right renal vein.
13. Section of the mouth of the left renal vein.
14. Veins of the fatty capsule of the kidney descending to join the spermatic veins which pass direct to the vena cava.
15. Lymphatic glands.
16, 17. Lumbar plexus.
18. Semi-lunar ganglion and solar plexus.
19. Aortic plexus of the sympathetic.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The kidney is situated at the side of the lumbo-dorsal portion of the vertebral column, external to the superior insertion of the psoas muscle, and in front of the quadratus lumborum muscle. It is retained in this position by rather slight attachments, the left kidney is placed a little higher than the right. These organs may be displaced in consequence of the weakness of their attachments, and in women who wear stays they are occasionally seen placed in the iliac fossa; this position explains how it is they may be found forming part of a hernia. It is important to be acquainted with these displacements, since the firm consistence and globular form of the organ might occasion it to be mistaken for a fibrous or cancerous tumour.

There are two kidneys, but this number is not invariable, sometimes there is only one which is then placed in front and across the vertebral column. I have frequently met with this arrangement in the fœtus at the Maternité; when that is the case, the two kidneys are usually united by their inferior extremities forming a kind of arch with the concavity directed upwards, and resting against the spinal column. They thus form a projection in front of the vertebræ and of the aorta which at every pulsation sends them forwards; in examining a patient in whom this disposition of the parts is present we might be led into the error of diagnosing an aneurism.

Wounds of the kidneys are very rare, which is accounted for by the depth at which they are placed; nevertheless cutting instruments may reach them through the lumbar region without the peritoneum being opened, because this membrane only covers their anterior surface. If the wound is only superficial, it will not be attended with any special danger; but if it is deep, the tubuli uriniferi are divided and their contents are effused, giving rise to the serious results which accompany infiltration of urine.

If external causes exercise but little action on the kidneys, this is not the case with regard to internal causes. These act in various ways; sometimes through the connexions they form with the neighbouring parts; sometimes through their relations with the genito-urinary apparatus and their connexions with the general system through the blood and the nervous system.

The parts connected with the kidneys are the peritoneum, the liver, the pancreas, the duodenum and the colon. It is easily understood that in a state of disease, when these parts are altered, modified and misplaced in various ways, they may injure the kidneys, compressing them and causing various disorders of greater or less importance. With regard to the communication of certain disorders of these parts to the kidney itself, by the contact of their tissues, this very rarely happens, being prevented by the fatty investment which envelopes and protects this organ.

Diseases of the genito-urinary apparatus have a great influence upon the kidneys, sometimes they spread to them by continuity of structure, and sometimes they affect them by causing retention of urine.

It is in this way that various diseases of the urethra and bladder in both sexes, of the prostrate, testicles, vesiculæ seminales, and the urethra in man, are evidently the origin of renal disease. To these causes must be added those connected with the nervous system and alterations in the blood.

The kidneys are subject to numerous disorders which of late years have been carefully studied, such as Bright's disease, and the serous degeneration which has been attributed to syphillis; it is sufficient to mention these diseases which belong to the subject of internal pathology.

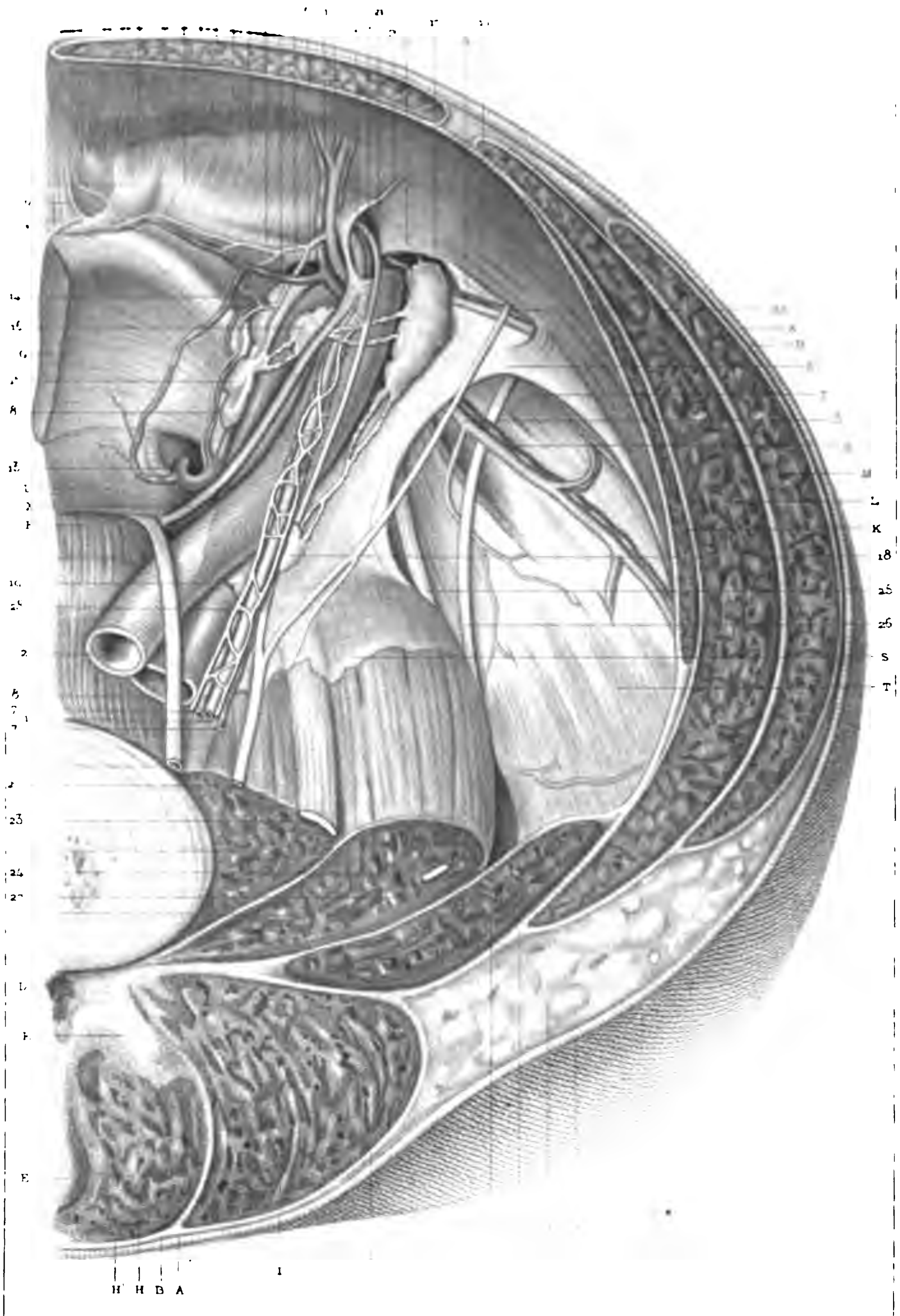
Cysts of the kidney are not uncommon, we have often met with them in the dead body when nothing had led us to suspect their existence. These cysts should be divided into large and small. The smaller cysts are situated at the surface and are very frequent; the larger cysts may acquire very considerable dimensions; they appear to commence in one of the tubuli uriniferi and sometimes in the calices. These tumours contain a fluid as transparent as water, constituting hydronephrosis, sometimes they contain gravel or pus, occasionally they are formed by hydatids, and M. Bauchet has reported to the *Société de Biologie* an instance in which the tumour opened into the bronchi.

Renal calculi are of frequent occurrence and follow upon calculous nephritis: the calculi are lodged in the calices and pelvis, gradually increasing in size they at the same time distend these organs, and may attain a considerable size without their presence being revealed by any symptoms, when suddenly after some change in their position or from some unknown cause they give rise to agonising pain, known as *nephritic colic*. When these calculi are small they may be expelled into the bladder; if they are of a larger size they cannot pass through the ureter without exciting pain in the course of the large and small abdominal branch of the lumbar plexus, and lower down along the track of the external and internal inguinal branches, so that according to the branch which is affected the surgeon may judge of the situation of the calculus. When the calculus is too large to pass, it remains in the kidney or its pelvis where it first causes inflammation, then hæmaturia and afterwards suppuration. It is in these extreme cases that nephrotomy might be of use. We have already said that no operation should be attempted until the purulent tumour forms a projection in the lumbar region.

The spleen, like the kidney, being deep seated is placed beyond the reach of injuries, yet it is more frequently wounded than the kidney, a circumstance which is explained by the brittleness of its tissue, by its larger size, and by its proximity to the ribs which easily transmit the effect of blows to it. Wounds, lacerations, and contusions of the spleen may be followed by interstitial or external hæmorrhage which is speedily fatal. I knew an instance where a female, in falling from one carriage on to another, struck her body in the region of the left flank and died in a few minutes in consequence of hæmorrhage from laceration of the spleen.

This Plate accurately represents the relations of the descending colon and of its sigmoid flexure. Its connexion with the kidney explains how certain renal calculi find their way into the descending colon. In the lumbar region the relations of the descending colon to the peritoneum and the abdominal parieties have enabled us previously to lay down the rules which should guide us in operating for artificial anus, as practised by Callison and Amussat. The position of the sigmoid flexure in the left iliac fossa clearly explains the method of Littre which should be adopted in preference to the former plan.

The abdominal aorta is here placed in the deepest part of the region and therefore out of the way of injuries; pointed, contusing and cutting instuments may however reach it as well as the large venous trunks which are beside it, such as the inferior vena cava, the vena portæ, or the renal veins. Wounds of these vessels are speedily fatal on account of the enormous hæmorrhage which immediately follows. If the common iliac, or the external or internal iliac arteries should be wounded, and we were called in time, a ligature should be immediately applied to the vessel on both sides of the wound. It is in such cases of wounded arterial trunks that compression of the abdominal aorta above the seat of the injury may be successfully employed while waiting for the application of the ligature. Compression of the abdominal aorta is also exceedingly useful in cases of uterine hæmorrhage, and as these hæmorrhages occur principally after delivery, the flacidity of the abdominal parieties greatly favours the application of this plan. The aorta can then be felt, as it were directly under the finger, and may be compressed against the front of the vertebral column. Care must be taken not to compress at the same time the inferior vena cava which is to the right of the aorta, as by that means the return of the blood to the heart would be checked, producing two bad effects, first it prolongs syncope if it is present, and secondly it retains the blood in the uterine sinuses from which it ought to escape. The abdominal aorta is liable to aneurism which may cause compression of the inferior vena cava, producing infiltration of the lower extremities. Ligaturing the aorta has been proposed in these diseases and where the vessel is wounded; we have already pointed out the extreme danger and uncertainty of this operation.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LVI.

Region of the Internal Iliac Fossa.

EXPLANATION.

A Section of the skin.
B. Section of the subcutaneous fascia.
B′. Section of the fatty cellular tissue of the lumbar region.
C. Section of the intervertebral disk separating the fourth and fifth lumbar vertebræ.
D. Spinal canal.
E. Spinous process of the fourth lumbar vertebra.
E′. Transverse process of the fourth lumbar vertebra.
F. Sacro-vertebral angle.
G. Vertical section of the symphysis pubis.
H. Semi-spinalis dorsi muscle.
H′. Aponeurosis of the same muscle.
I. The common muscular mass.
I′. Aponeurosis of the same.
J. Quadratus lumborum muscle.
K. Section of the transversalis abdominis muscle
L. Section of the obliquus abdominis internus muscle.
M. Section of the obliquus abdominis externus muscle.
N. Aponeurosis of the preceding muscles going to be inserted into the base of the taansverse process.
O. Crural arch.
O′. Gimbernat's ligament.
P. Section of the rectus abdominis muscle.
P′. Insertion of the rectus abdominis muscle into the pubis.
P″. Arch formed by the fascia transversalis bounding the external margin of the external inguinal fossa.
P‴. Middle inguinal fossa covered by the fascia transversalis.
P⁗. Fascia transversalis lining the fibres of the rectus abdominis muscle.
P′′′′′. Tendinous projection forming the boundary between the middle and internal inguinal fossa.
P′′′′′′. Internal or vesico-pubic fossa.
Q. Linea alba.
R. Depression between the linea alba and the inner edge of the tendon of the rectus abdominis muscle.
S. Section of the psoas magnus muscle.
S′. Section of the psoas parvus muscle.
S″. Aponeurosis of the psoas muscles.
T. Iliacus muscle.
T′. Iliac fascia.
U. Aponeurosis of the levator ani muscle.
V. Section of the urethra.
X. Vas deferens.

1. Spermatic artery.
2. Section of the common iliac artery.
3. First circumflex iliac artery.
4. Second circumflex iliac artery.
5. Division of the epigastric artery.
6. Pubic artery coming from the epigastric artery.
7. Branch furnished by the pubic artery giving branches to the lymphatic glands and anastomosing afterwards with the obturator artery.
8. Spermatic veins.
9. First circumflex iliac vein.
10. Second circumflex iliac vein.
11. Epigastric veins.
12. Divisions of the epigastric veins coming from the pubic and obturator veins.
13. Obturator vein.
14. Lymphatic glands situated on the external edge of Gimbernat's ligament.
15. Lymphatic gland situated on the inner side of the external iliac vein.
16. Lymphatic glands situated on the external iliac vein.
17. Large lymphatic gland situated on the outer side of the external iliac artery just as it is about to enter the crural canal.
18, 19. Lymphatic glands situated in the course of the external iliac vein.
20. Inguino-crural branch of the lumbar plexus.
21. Branch of this nerve accompanying the cord.
22. Nervous branch going to the skin on the anterior surface of the thigh.
23. Section of the nerve belonging to the fourth pair of lumbar nerves going to form the crural nerve.
24. Section of the nerve belonging to the third lumbar pair which assists in forming the crural nerve.
25. Trunk of the third pair of lumbar nerves.
26. External cutaneous, trunk of the second pair of lumbar nerves.
27. Section of the second pair of lumbar nerves.
28. Spermatic plexus.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The iliac fossa is one of the regions most abundant in pathological and practical deductions; each of its constituent portions may give rise to important considerations; we shall, however, confine our attention to three principal subjects: abscesses, the arteries and the application of ligatures to them, and hernias.

Abscesses are of frequent occurrence in the iliac fossa, they may be either idiopathic or symptomatic. From whatever cause they arise, these abscesses may be seated in any of the various layers of the region. In this respect the following varieties may be established: 1. peritoneal abscess; 2. sub-peritoneal abscess; 3. sub-aponeurotic abscess; 4. inter-muscular abscess; 5. sub-muscular abscess; 6. sub-periosteal abscess; 7. abscess connected with osteitis.

The first form of abscess is the result of circumscribed peritonitis, and arises from various causes, such as inflammation of the cæcum and of the sigmoid flexure of the colon; inflammation and suppuration of the ovary or of the appendages of the uterus, as happens after childbirth. These abscesses terminate in various ways; they may give rise to peritonitis, which gradually extends and terminates fatally; or they may become encysted, and terminate by opening into one of the natural passages in their vicinity, such as the cæcum, the sigmoid flexure of the colon, the small intestine, the bladder, the rectum, the vagina, or even the uterus. This termination is sometimes followed by a cure. They may also form a passage through the abdominal parietes, and when this is the case it is almost invariably situated above the crural arch, which they render prominent, and it is then they should be opened.

Abscesses of the second kind sometimes follow the first, or they may be produced from similar causes in the cellular tissue placed between the peritoneum and the iliac aponeurosis. These abscesses give rise to the same modes of termination, but they more frequently open next to the thigh following the direction of the openings through which the vessels and the nerves of the thigh pass. Thus they take the direction of the inguinal nerves, or rather of the crural canal, and they are distinguished from the preceding by opening below the crural arch. All these sub-aponeurotic abscesses, whatever their depth, being confined by the aponeurotic sheath of the psoas and iliacus muscles, or by the iliac fascia converge towards the small trochanter, that is to say, towards the inner side of the thigh, below the femoral vessels; while the former project at the commencement of the inferior extremity in front of the same vessels. These abscesses present certain distinctive characters; thus the pus may destroy or dissect out the psoas and iliacus muscles. Caries of the bone sometimes produces perforation of the os innominatum, and the deep abscesses which result open towards the buttock below the glutei muscles. Blandin saw an instance of this mode of termination, where nature seemed to point out to the surgeon the course to be followed in giving exit to the pus of these deep abscesses. Percy has several times perforated the os innominatum in cases of this kind.

Cutting instruments can only reach this region after having passed through the anterior abdominal wall; if they penetrate to the interior, they open the peritoneum, and, almost as a matter of necessity, wound the iliac vessels. External wounds are always of less importance; on the one hand, because there are no large vessels on that side, and on the other, because the peritoneum is not involved. Occasionally the internal iliac fossa has been wounded by instruments which had probably passed through the buttock and os innominatum. Bullets and fragments of shell have frequently pursued this complicated course, as Blandin witnessed in the wounded in July, 1830, and which we also saw in the case of a man who was wounded by a gun charged with buck shot.

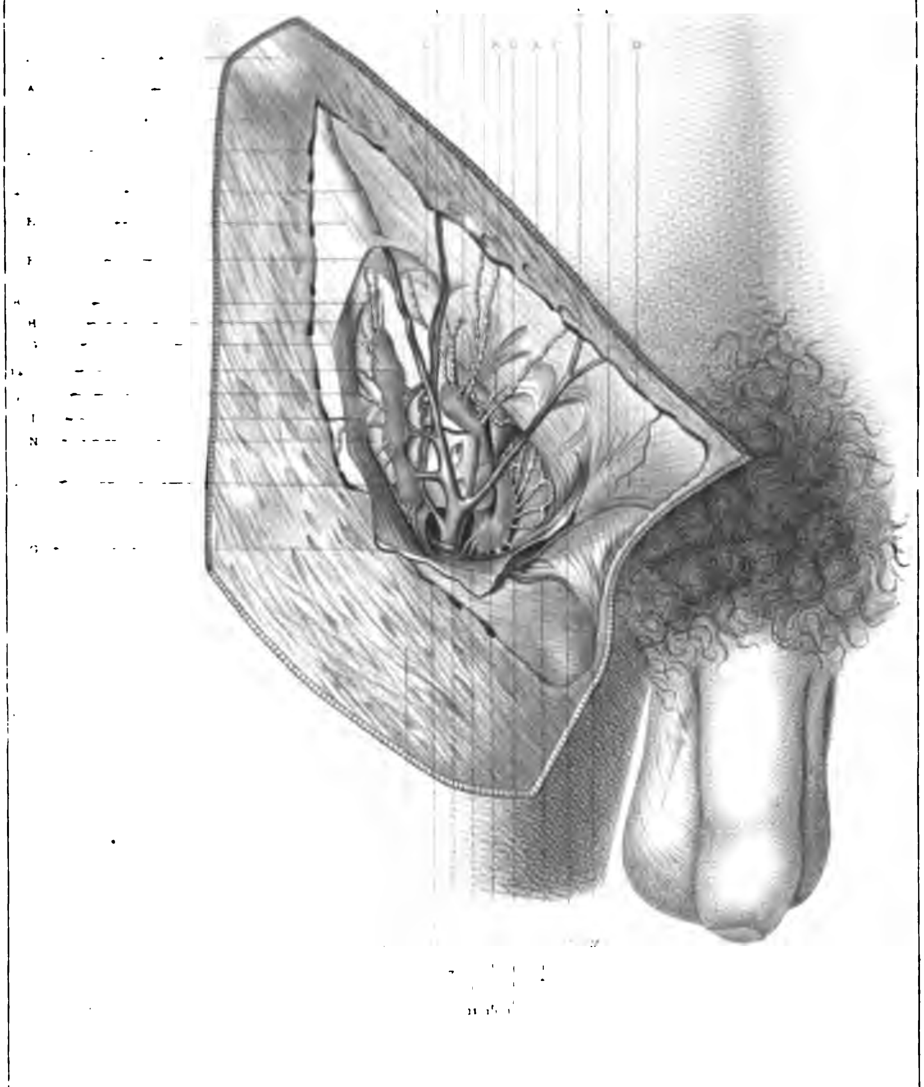
Numerous large vessels, such as the common iliac, the internal and external iliac, occupy the internal part of the region; and as it is on this region we must operate for the purpose of applying a ligature to them, we shall now speak of the anatomical principles upon which these operations are based.

The external iliac artery was tied for the first time by Abernethy in 1796. Stevens (of Santa Crux) tied the internal iliac for aneurism in the buttock. Valentin Mott was the first to tie the common iliac for aneurism of the external iliac. All these surgeons reached the artery by making an opening through the walls of the abdomen; we have already laid down the rules which should guide the surgeon in making an opening into the abdominal parietes.

However formidable the application of a ligature to the common iliac artery may appear, the operation has, nevertheless, been successful, and anatomy shows that the anastomosis is sufficient to maintain the vitality of the adjacent parts. It is evident that the anastomosis of the epigastric artery with the internal mammary, those of the circumflex iliac and ilio-lumbar with the lumbar arteries, and the still more numerous and larger communications which take place in the pelvis between the branches of the two internal iliac arteries, are sufficient to maintain the circulation in the lower extremity, and in the lateral part of the pelvis. It is to be observed that the clot in the common iliac artery will be less driven against by the force of the circulation, in proportion to the facility of communication between the internal iliac artery and that of the opposite side. There is still greater reason to be confident of a continuation of the circulation in the lower parts after the application of a ligature to either the internal or external iliac artery, since one of the two vessels continues to receive the blood, and as they both communicate freely together, that which is intact supplies the branches of that which has been tied.

With regard to hernia, the inclination of the iliac fossa forwards, inwards and downwards, impels, so to speak, the contained viscera towards the natural openings of the part, and hence the facility with which hernias are produced. This cavity represents a kind of funnel, of which the narrow opening corresponds to the internal abdominal rings; it is not, therefore, surprising that the viscera should make their way through these openings, towards which they are naturally carried by their own weight, and by the inclination of the iliac fossa. At this part is seen the internal openings of the inguinal and crural canals. On the external and falciform margin of Gimbernat's ligament, is a small artery furnishing two branches; one, the pubic artery, passes along the posterior surface of the ligament; the other passes into the pelvis, this artery anastomoses with the obturator, and is sometimes so voluminous as to become the obturator itself. It will be seen that if the stricture is divided within the crural canal, these two small branches might be wounded. If they were small, as in the present case, their division would not cause any serious danger; but if, as is often the case, the obturator artery was large, the hæmorrhage would be serious. In order to avoid this accident, the surgeon should ascertain, by means of the finger, if there is any arterial pulsation at the seat of structure before using the bistouri. On the internal border of the inguinal canal is the epigastric artery, which is always of considerable size, and must be avoided at every hazard in operating for inguinal hernia. We shall have to refer again to these points when speaking of the inguino-crural region.

The bones of the ilium are liable to all kinds of fractures arising from various causes. Without here referring to the fractures which occur in the vicinity of the cotyloid cavity, or to those which belong to the pubis or its processes, we may say that the part of the ilium belonging to the region with which we are occupied may be fractured in the iliac fossa, at the crest of the ilium, or at the spinous processes of the ilium. These fractures are produced by a cause acting directly upon the part, or by laceration. M. Legouest (*Traité de chirurgie d'armée*, 1863) mentions several instances of fracture of the iliac bones from gun-shots. In this excellent treatise a case is given of fracture from a gun-shot of the left iliac bone, of which the preparation is in the Museum at Val-de-Grâce. M. Legouest at pp. 576, 577, describes a case in which a bullet had perforated the iliac fossa.



LIBRAIRIE GERMER BAILLIERE

PLATE LVII.

Inguino-crural Region.

Superficial layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Anterior superior spine of the ilium covered by the tendinous fibres which are inserted into it, or which pass in front of it.
C. First layer of the superficial fascia of the abdomen and the thigh.
D. Section of the first layer of the superficial fascia.
E. Second layer of the superficial fascia.
F. Section of the second layer of the superficial fascia.
G. Second layer of the superficial fascia turned outwards.
H. Insertion of the second layer of the superficial fascia of the thigh into the anterior surface of the oblique aponeurosis and into Poupart's ligament, forming the arch beneath which the blood vessels and lymphatics pass.
I. Second series of fibres of the second layer of the superficial fascia going to be inserted into the external part of the cribriform fascia.
J. Fibres of the second layer of the superficial fascia passing to be inserted into the inner portion of the crural arch.
K. Middle fibres of the second layer of the superficial fascia passing to be inserted into the anterior part of the femoral arch and receiving in its turn the insertion of the fibres of the first layer of the superficial fascia.
L. Poupart's ligament and its relations with the two layers of the superficial fascia.
M. Fibres of the dartos going to be inserted on the exterior of the external orifice of the inguinal canal.
N. Cribriform fascia on which the blood vessels and lymphatics rest as well as the superficial ganglia of the region contained in an aponeurotic space.
O. Internal and superior margin of the cribriform fascia inserted into the internal portion of the crural arch and at a greater depth to the anterior surface of Gimbernat's ligament.

1. Artery of the abdominal integument giving in its course branches to the lymphatic glands.
2. External pudic artery and its ramifications.
3. Cutaneous vein receiving the branches which come from the lymphatic glands.
4. External branch passing to join the cutaneous vein of the abdomen.
5. Internal branch emptying itself into the cutaneous vein of the abdomen.
6. Pudic and pubic veins seen through the superficial fascia and the dartos.
7. Lymphatic vessels coming from the abdominal parietes.
8. Lymphatic vessels coming from the external region of the buttock.
9. Lymphatic vessels coming from the buttock and external margin of the anus.
10. Lymphatic vessels coming from the anterior and external surface of the thigh.
11. Lymphatic vessels coming from the antero-external surface of the thigh.
12. Lymphatic vessels following the course of the pudic vein and coming from the scrotum.
13. Middle lymphatic glands receiving the lymphatic vessels from the abdominal parietes.
14. Lymphatic gland much elongated receiving the external lymphatic vessels.
15. Internal and deep-seated lymphatic gland receiving the lymphatic vessels from the internal part of the thigh and scrotum, and furnishing emergent vessels which pass into the abdomen beneath the crural arch.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Lesions of the superficial layer of the inguino-crural region are tolerably frequent, and vary, not only as regards their importance, but also with respect to the situation they occupy. It is sufficient to examine the plate to perceive that they may be situated in the skin, in the two layers of the superficial fascia, or in the vessels or glands of the region.

The skin of the region is very thin and only slightly adherent; externally it is not furnished with hair, but only with down; it contains sebaceous glands, which may become hypertrophied and attain the size of a pea. I have shown that in certain women these glands become hypertrophied during pregnancy. The constant friction which occurs in this region renders these glands liable to inflammation, and M. Huguier, who has described this inflammation, has seen cases where these tumours have been mistaken for syphillitic growths. The skin, being only slightly adherent, is easily raised up, and for this reason, in operating for hernia it is advisable to pinch up a fold which may be divided without any fear of wounding the parts beneath. Its thinness explains why it readily undergoes alterations, becomes irritated and inflamed at the surface like a true mucous membrane, as is seen to be the case in infants that are very fat.

As in all regions where there is much movement, the subcutaneous tissue encloses only a small quantity of fat; hence the rarity of lipoma; but on the other hand the cellular tissue is lax and liable to become inflamed, giving rise to phlegmonous inflammation of the groin developed either primarily or secondarily. In the operation for hernia this layer is usually divided at the same time as the skin, so that we arrive directly at the fascia. This superficial fascia is generally more fibrous in thin or old persons; in operating on the latter the hernial sac will also be found very thin and resisting. This explains why in such cases the sac is quickly exposed, and why the hernial tumour is not of a large size in the crural region.

This region contains the artery and vein of the abdominal integument as well as the superficial branches of the external pudic arteries and veins. It must be remembered that these vessels first pass over the superficial fascia and farther from their origin between the two layers of this fascia. In operating for crural hernia these vessels are found in front of the hernial tumour. Before reaching the sac it is necessary to divide and ligature them. In fat subjects, they may serve as excellent guides. In a case of crural hernia, where I lately operated with my colleague, M. Aubrun, the vessels of the integument were situated at the middle of the tumour, which they bound down and divided into two lobes; with regard to the pudic vessels, they were situated to the inner side of the tumour, and sub-divided the internal lobe into two smaller lobes.

The veins of the region sometimes become varicose, and their dilitations give a curious appearance to the abdominal parietes, which has received the name *caput Medusæ*. This varicose condition is the more easily brought about, as the circulation of the integument is almost entirely in opposition with that of the saphena vein, which from its size and force overcomes that of the former

The lymphatic glands form three groups. Their number is not accurately determined, and, moreover, it is liable to vary according to the age, the pathological condition, and even the sex. It remains to point out the conditions which cause them to vary in number and in size. I can state that I have frequently found these glands increased both in number and in size during pregnancy; I have even laid down certain rules by which to diagnose the existence of pregnancy, and to distinguish between the condition of the glands in pregnancy and in disease.

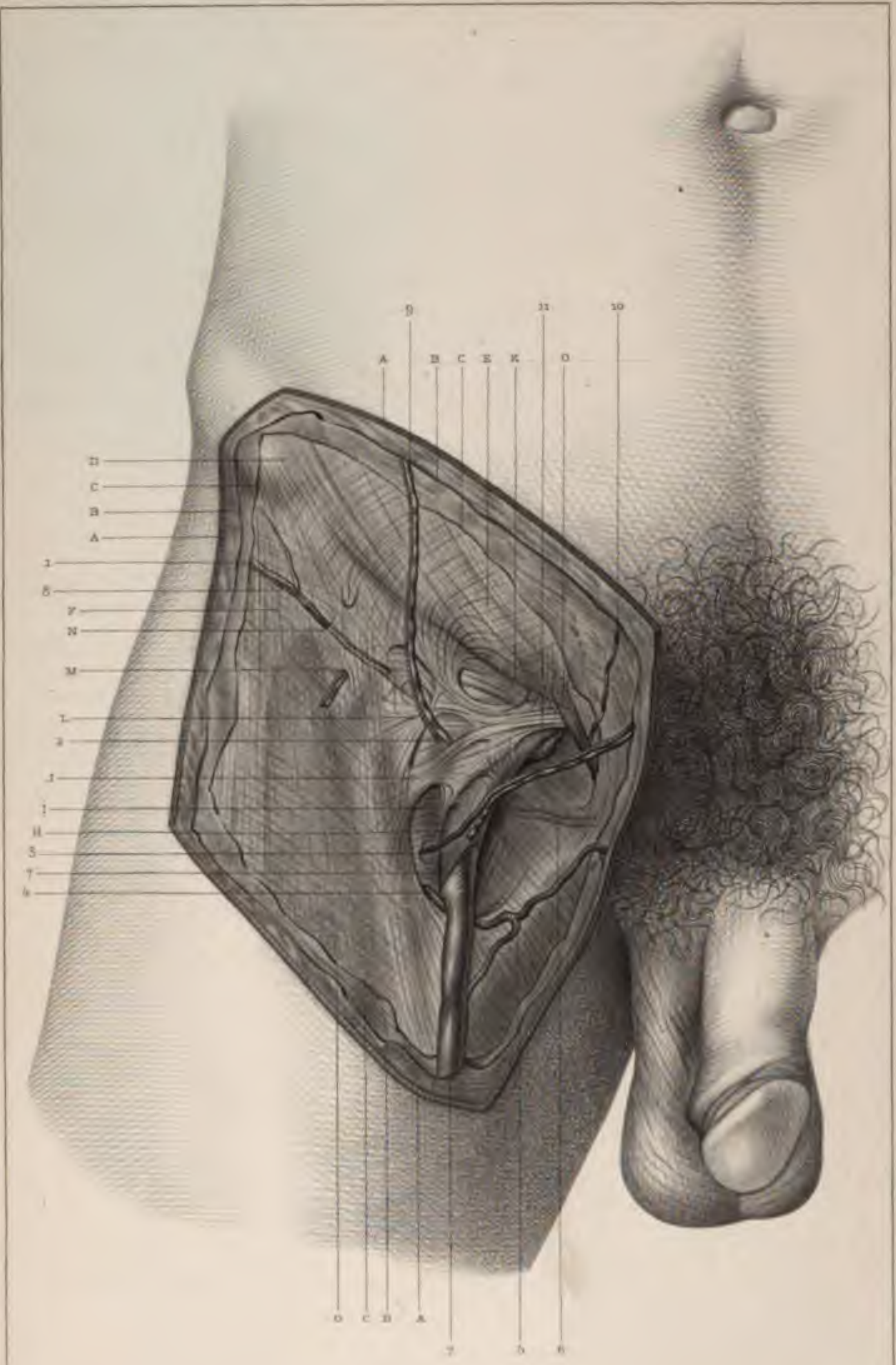
The lymphatic vessels which join these glands come: 1. from the inferior extremity; 2. from the buttock and from the lumbar region; 3. from the anterior wall of the abdomen; 4. from the scrotum, penis and perineum passing round the thigh; 5. from the deep parts of the thigh. It follows from this that all inflammations occurring in these regions may originate in the groin; so constantly is this the case, that we may, from the condition of the affected gland, diagnose the point from whence the mischief has arisen. Thus in inflammation of the lower extremity, it is the lowest gland which will be affected; in diseases of the genital organs the inner group will be affected; in diseases of the abdomen, of the buttock, and of the lumbar region, and sometimes of the anal region the superior and the external glands will be affected.

The nerves present nothing of importance in a surgical point of view.

From these considerations we learn that wounds and inflammations, seated in the first layer, are seldom of much consequence; in fact, the vessels are not of a sufficient size to give rise to a continous hæmorrhage. Still, in performing the operation for crural hernia, in order to prevent the blood obscuring the course of the knife, it is advisable to place a ligature on the extremity supplying the blood which in this instance is the lower.

Abcesses occupying the superficial layer may be seated: 1. beneath the skin; 2. between the layers of the superficial fascia; 3. beneath the superficial fascia; and 4. in the sheath of the lymphatic glands. The latter is almost invariably the result of inflammation of the lymphatic glands. There is considerable risk in opening them, of dividing the superficial branches of the artery, and of the veins of the abdominal integument.

Several important operations are performed in this region, such as the taxis, the operation for hernia, and ligaturing the femoral artery; we shall have to refer again to the two latter operations; we shall here only remark that the bandages which are intended to retain a hernia should be provided with soft pads, so that the skin which is fine and thin is not injured by the contact of any rough surface. We will now speak of the application of a ligature to the femoral artery in the upper third of the thigh, or in the inguinal triangle. The femoral artery is here contained in a triangle whose base corresponds to the crural arch, while its apex is placed ten centimetres (3·937 English inch) lower down where the sartorius muscle and the adductor longus muscle meet. Throughout the whole of this space, it is only covered by the cribriform fascia, the funnel shaped passage for the vessels, and more superficially by the skin and the superficial fascia; so that during life it may be easily felt by its pulsations. If this indication should be absent, its direction may be obtained by drawing a line from the middle of the crural arch to the apex of the triangle, it will be found at from seven to eight millimetres (·275 to ·314 English inch) within this line. An incision so made in this direction seven to eight centimetres (2·75 to 3·14 English inch), taking care not to incline it too much inwards for fear of wounding the saphena vein. If large glands are met with, they must be removed; the aponeurosis being exposed, it is opened on a grooved director, and the artery comes into view.



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LIBRAIRIE GERMER BAILLIÈRE.

PLATE LVIII.

Inguino-Crural Region

Middle Layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. Anterior superior spine of the ilium with the insertions of Poupart's ligament and the aponeurosis of the thigh.
E. Aponeurotic fibres of the obliquus externus abdominis going to form Poupart's ligament and the pillars of the external opening of the inguinal canal, interlacing lower down with the fibres of the cribriform fascia.
F. Femoral aponeurosis.
G. Aponeurosis of the thigh, beneath which is seen the fibres of the sartorius muscle.
H. Cribriform fascia covering the femoral vein.
I. Cribriform fascia covering the femoral artery.
J. Band of the cribriform fascia going to be inserted above Poupart's ligament, and below and externally to the femoral aponeurosis.
K. Other tendinous fibres of the cribriform fascia inserted into Poupart's ligament.
L. Tendinous fibres of the cribriform fascia passing from the femoral aponeurosis and bounding the openings through which the blood vessels and lymphatics pass.
M. Small fibrous opening in the cribriform fascia.
N. Small fibrous opening in the cribriform fascia giving passage to vessels.
O. External fibres of the dartos muscle.

1. External branch coming from the femoral artery.
2. Artery of the integument of the abdomen traversing the cribriform fascia.
3. Superior branch of the external pudic artery traversing the cribriform fascia.
4. Inferior branch of the external pudic artery passing beneath the internal saphena vein.
5. Division of the external pudic artery into two branches, the scrotal and the femoral.
6. Deep branch of the external pudic.
7. Internal saphena vein passing between the two layers of the superficial fascia of the thigh.
8. Vein coming from the region of the buttock.
9. Vein of the abdominal integument.
10. Branch of the external pudic vein.
11. Lymphatic gland situated beneath the inner margin of the cribriform fascia.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate is intended to show more particularly the cribriform fascia and its relations to the crural canal and the vessels of the region. This aponeurotic layer descends in front of the femoral vessels, covers them, and is attached to the anterior surface of the sheath of the psoas externally, and of the pectinalis internally. It is formed of short fibres which bound the numerous openings for the passage of the blood vessels and lymphatics. This fascia is much firmer and more resisting near its external margin than towards its internal, which offers the largest number of openings. It is through this weaker portion and in consequence of the enlargement of these openings that a crural hernia passes out of the canal of that name. The upper part of the fascia is falciform, narrow, concave, and assists in forming an opening to allow of the passage of the internal saphena vein into the sheath of the femoral vessels, where it unites with the femoral vein. It has been thought that this fascia compressing the vein from below upwards, impeded the course of the blood and produced a varicose condition of the veins of the lower extremity. This may be true in some cases, but it is not invariably so, for those who have proposed to divide this fold of membrane, and have done so after the example of Herapra, have not succeeded in curing the varicose condition of the veins, which ought certainly to have been the case if this impediment had been the true cause.

With regard to hernia; this Plate shows that a hernia which occupies the crural portion of the groin will have the following coverings: 1. the skin; 2. the subcutaneous fatty cellular tissue; 3. the two layers of the superficial fascia, between which are placed the vessels of the integument and the pudic vessels; 4. the deep fascias which we shall see are furnished by the fascia transversalis, and the peritoneum.

As the tumour proceeds from the deep layers towards the superficial, it follows that it becomes invested with every structure that lies in front of the cribriform fascia; amongst these there are lymphatic glands and vessels which are of great importance in the operation for crural hernia. Thus, referring only to the glands, they may be found hypertrophied, engorged or inflamed, in front of the sac; and it is consequently occasionally necessary to remove some of them in order to expose the sac; hence sometimes the propriety of opening an abscess in front of a hernial or aneurismal sac. At the same time we can conceive the various mistakes which a careless practitioner may commit in the diagnosis of tumours in the inguino-crural region from the mere presence of these glands.

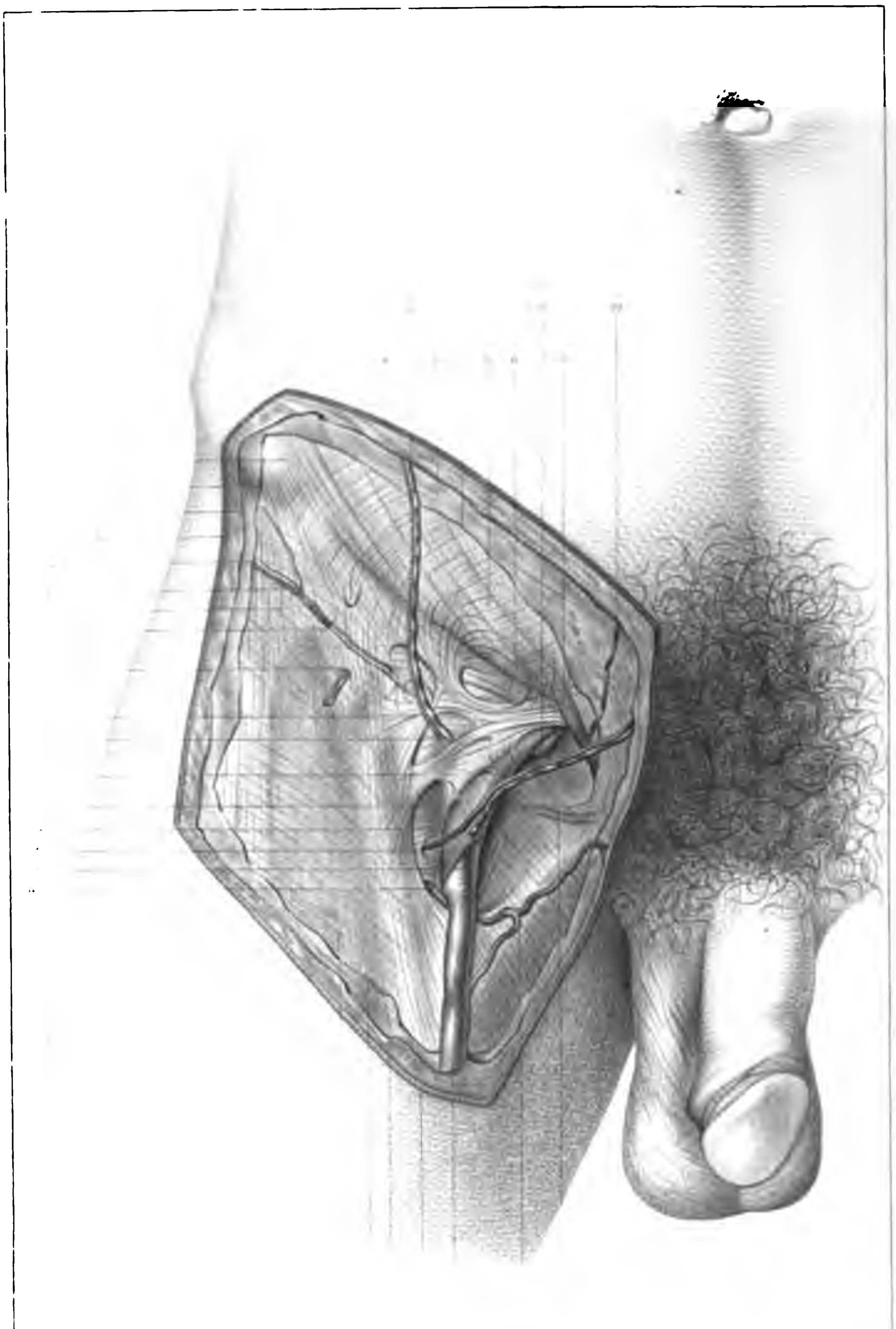
With regard to that portion of the region which is above Poupart's ligament, we have to observe that the anterior wall of the crural canal is here formed by the aponeurotic fibres of the external oblique muscle of the abdomen It is also seen that the artery and vein of the abdominal integument pass in front of this wall, so that in the incision which is made through the skin to expose either the external iliac, or the epigastric artery, we are compelled to divide these two vessels before opening the aponeurosis.

From the relative positions of the inguinal and crural canals, we may determine the distinctive characters of an inguinal or a crural hernia. Thus, by drawing a line from the anterior superior spine of the ilium to the symphysis of the pubis, if the tumour is placed above this imaginary line, then it is an inguinal hernia; while, on the contrary, if it is below it is a crural hernia.

Considerable discussion has taken place as to the agent which produces the strangulation of a hernia in the present region. An examination of the inguinal canal in this Plate, in the following one, or in Plate LVI, proves that the strangulation may be produced at either end of the canal; but it occurs most frequently at the external orifice, which is the narrowest. It sometimes takes place above the surperficial ring by means of fibrous bands, from rupture of the sac, or in the neck of an old sac in which the new sac has become included. Lastly, the neck of the hernial sac itself may increase in thickness and density, and the strangulation be caused by the neck of the sac, which, according to Duputryen and M. Malgaigne, is frequently the case. According to M. Velpeau, the strangulation usually occurs at the rings of the inguinal canal, and it is only in certain old hernias that it is produced by the neck of the sac.

We fully participate in this opinion, which has the great advantage of not being exclusive. What may have given rise to the mistake is, that when the strangulation is situated at the internal ring, in pressing back the hernia the fascia transversalis is also pushed back, and the hernia is then returned sufficiently to carry it beyond the external ring. If, during the operation, the finger is introduced into the inguinal canal, we soon meet with a ring that may be easily carried into the abdomen; from this circumstance it has been supposed that this ring is the neck of the sac, while in reality it is the internal ring of the inguinal canal separated from the wall of the abdomen. As in some cases where the hernia has been reduced *en masse* the symptoms have continued, it has been supposed that the sac has been returned along with the intestine, and the strangulation has been attributed to the neck, while it arose entirely from the internal ring. The relations of the vessels to the external and internal ring clearly show that the division of the strangulation should be always made outwards and upwards.

With regard to the crural canal, the strangulation is almost always caused by the enlargement of one of the openings of the fascia cribriformis. It is very rarely that the neck of the sac is the cause of the strangulation. In one case in which I operated, I clearly ascertained that the strangulation was situated outwards and below, and that it depended upon a band of the fascia cribriformis.



Lebrun sc.

LIBRAIRIE GERMER BAILLIÈRE

PLATE LVIII.

Inguino-Crural Region

Middle Layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. Anterior superior spine of the ilium with the insertions of Poupart's ligament and the aponeurosis of the thigh.
E. Aponeurotic fibres of the obliquus externus abdominis going to form Poupart's ligament and the pillars of the external opening of the inguinal canal, interlacing lower down with the fibres of the cribriform fascia.
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10. Branch of the external pudic vein.
11. Lymphatic gland situated beneath the inner margin of the cribriform fascia.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate is intended to show more particularly the cribriform fascia and its relations to the crural canal and the vessels of the region. This aponeurotic layer descends in front of the femoral vessels, covers them, and is attached to the anterior surface of the sheath of the psoas externally, and of the pectinalis internally. It is formed of short fibres which bound the numerous openings for the passage of the blood vessels and lymphatics. This fascia is much firmer and more resisting near its external margin than towards its internal, which offers the largest number of openings. It is through this weaker portion and in consequence of the enlargement of these openings that a crural hernia passes out of the canal of that name. The upper part of the fascia is falciform, narrow, concave, and assists in forming an opening to allow of the passage of the internal saphena vein into the sheath of the femoral vessels, where it unites with the femoral vein. It has been thought that this fascia compressing the vein from below upwards, impeded the course of the blood and produced a varicose condition of the veins of the lower extremity. This may be true in some cases, but it is not invariably so, for those who have proposed to divide this fold of membrane, and have done so after the example of Herapra, have not succeeded in curing the varicose condition of the veins, which ought certainly to have been the case if this impediment had been the true cause.

With regard to hernia; this Plate shows that a hernia which occupies the crural portion of the groin will have the following coverings: 1. the skin; 2. the subcutaneous fatty cellular tissue; 3. the two layers of the superficial fascia, between which are placed the vessels of the integument and the pudic vessels; 4. the deep fascias which we shall see are furnished by the fascia transversalis, and the peritoneum.

As the tumour proceeds from the deep layers towards the superficial, it follows that it becomes invested with every structure that lies in front of the cribriform fascia; amongst these there are lymphatic glands and vessels which are of great importance in the operation for crural hernia. Thus, referring only to the glands, they may be found hypertrophied, engorged or inflamed, in front of the sac; and it is consequently occasionally necessary to remove some of them in order to expose the sac; hence sometimes the propriety of opening an abscess in front of a hernial or aneurismal sac. At the same time we can conceive the various mistakes which a careless practitioner may commit in the diagnosis of tumours in the inguino-crural region from the mere presence of these glands.

With regard to that portion of the region which is above Poupart's ligament, we have to observe that the anterior wall of the crural canal is here formed by the aponeurotic fibres of the external oblique muscle of the abdomen It is also seen that the artery and vein of the abdominal integument pass in front of this wall, so that in the incision which is made through the skin to expose either the external iliac, or the epigastric artery, we are compelled to divide these two vessels before opening the aponeurosis.

From the relative positions of the inguinal and crural canals, we may determine the distinctive characters of an inguinal or a crural hernia. Thus, by drawing a line from the anterior superior spine of the ilium to the symphysis of the pubis, if the tumour is placed above this imaginary line, then it is an inguinal hernia; while, on the contrary, if it is below it is a crural hernia.

sufficient reason to condemn the application of a ligature at the apex of the triangle, where it is specially indicated; nearer to the crural arch not only the irregularities but the normal disposition presents considerable danger. So that Viguerie has proposed in preference to ligature, the external iliac, a proposal which is deserving of our serious consideration."

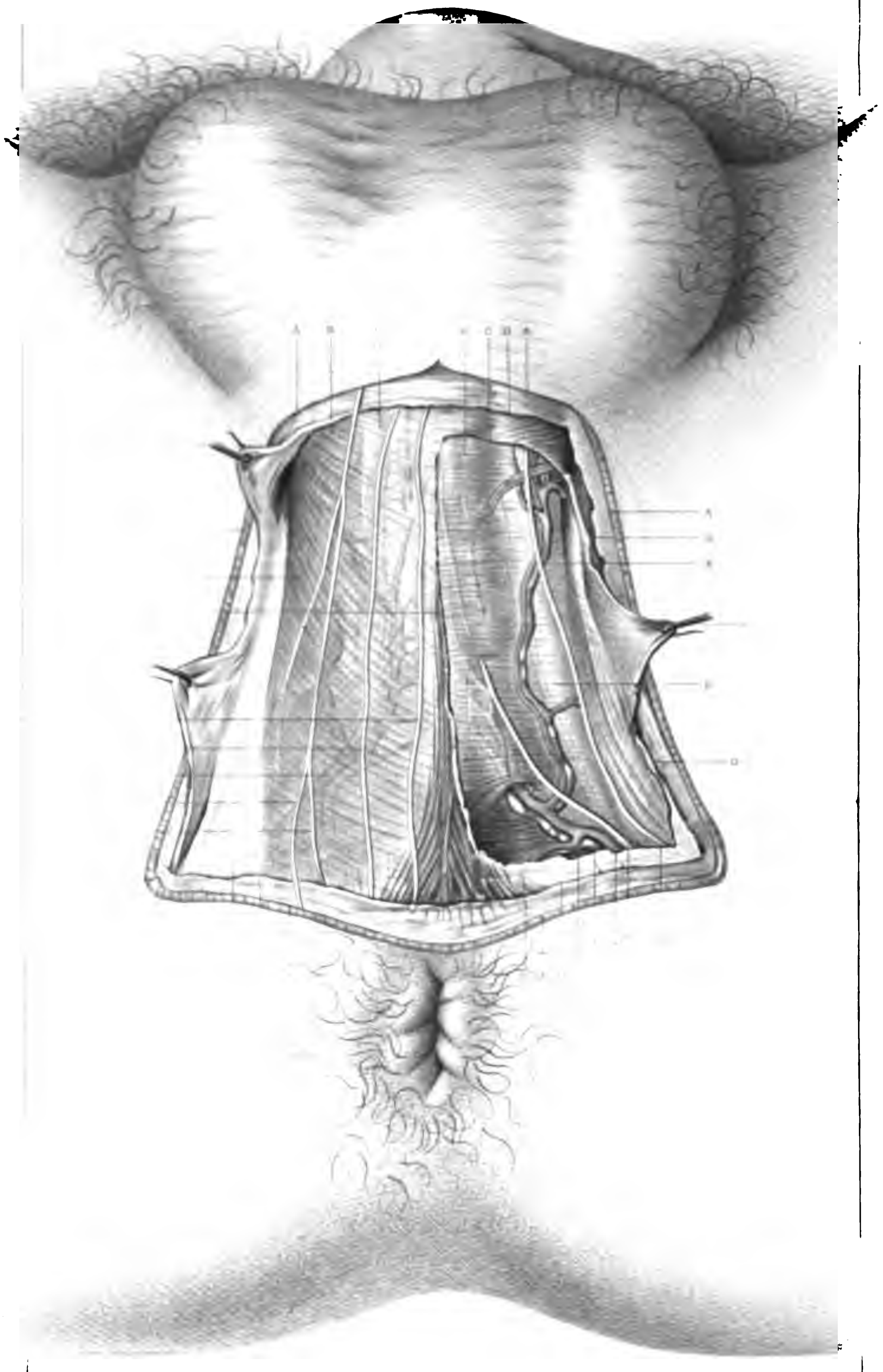
With regard to the crural vein, its great size must be noticed, from whence the danger which ensues when it is wounded; it also presents this peculiarity, that it forms the conflux of nearly all the veins of the inferior extremity, of the external organs of generation, and of the wall of the abdomen; so that should it be obliterated, the returning current of the circulation is greatly impeded; some ancient and modern authorities consider that the application of a ligature to this vein, in the case of its being wounded, must necessarily be followed by gangrene of the lower limb. This view, although true in some cases, is not generally so, inasmuch as the deep veins of the posterior part of the thigh and the superficial veins of the anterior part, may sufficiently restore the venous circulation when the principal trunk is obliterated.

Above, the vein partially covers the artery, sometimes it is the reverse. The intimate connection of these two vessels readily explains the facility with which an arterio-venous aneurism may be formed in this region. Some years back I saw a case under the care of M. Nélaton, in which the sound produced by the aneurism might be heard all over the body, it was so intense and easily transmitted. A cellular partition often covers the inner edge of the vein and divides the infundibular space into two compartments; one external occupied by the femoral vessels; the other internal containing only lymphatic vessels and cellular tissue, and forming the true ***hernial crural canal***.

The spermatic canal, together with the spermatic and testicular arteries, is only separated anteriorly from the femoral vessels by the crural arch covered by the fascia transversalis, so that if the stricture of a crural hernia was divided forwards these organs would be liable to be wounded.

As regards the contents of the inguinal canal they are of less importance in regard to operative surgery. Plate LVI shows the parts which enter into the structure of the cord; the reader is, therefore, referred to that Plate for what relates to the practical applications. The external pudic vessels enter the inguinal canal and pass in front of the cord. Any incision made for the purpose of exposing an external inguinal hernia must divide these vessels, but they are not of such a size as to cause hæmorrhage. The skin which passes in front of the inguinal canal being very loose and yielding, the surgeon has endeavoured to press it up into the inguinal canal in order to obliterate or close it up, with a view of preventing the viscera from protruding, and so effect a radical cure of inguinal hernia. From this has arisen various methods which have been more or less successful in obtaining the desired result. At present, however, this part of operative surgery has not been generally adopted by surgeons. As regards the patients, they often prefer wearing a bandage all their lives rather than submit to an operation of which the success is doubtful.

PLANCHE LX



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LX.

Region of the Perineum in the Male.

First layer

EXPLANATION.

RIGHT SIDE.

A. Section of the skin bounding the region.
B. First layer of the superficial fascia.
C. Second layer of the superficial fascia.
D. Insertion of the fibres of the external sphincter muscle of the anus into the aponeurotic raphé of the perineum.

1. Superficial arteries and veins of the perineum seen through the superficial fascia.
2, 3. Terminal branches of the internal pudic nerve.
4, 5. Branches coming from the small sciatic nerve.

LEFT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. The most external fibres of the external sphincter of the anus.
E. Superficial aponeurosis of the perineum.

1. Superficial artery of the perineum.
2. Superficial vein of the perineum.
3. Superficial nerve of the perineum coming from the internal pudic nerve.
4. Second superficial nerve coming from the small sciatic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In a pathological point of view, the first layer of the perineum in man gives rise to some important considerations. The skin, which is continuous with that of the neighbouring parts, presents along the median line a kind of raphé, which, however, does not always arrest the extension of disease: it is furnished with hairs and follicles which moisten the part and give it a kind of shiny appearance. Sometimes these follicles become inflamed and give rise to boils which are extremely painful; they are by no means unfrequent, in consequence of the friction to which the parts are exposed in walking. The subcutaneous cellular tissue is abundant and extends like the skin into the neighbouring regions; it is, however, somewhat more compact than in those regions. As in other parts, it may become inflamed and thickened, or it may be infiltrated with pus, blood, urine, or even with stercoracious matter, and with every other kind of liquid, solid, or gaseous matter. Superficial abscesses of the perineum present nothing peculiar when they are seated in this cellular tissue; they are to be treated in the same way as in other regions; they are especially apt to occur after inflammation of the glands and follicles of the hair, whose inflammation is transmitted to the surrounding cellular tissue. Symptomatic abscesses sometimes occur in the perineum; when this happens they depend upon disease of the bones, of the urinary passage, or of the intestines. Induration of the cellular tissue is very common from long standing inflammation, or from the presence of an urinary or stercoracious fistula in the region. This induration, which in the first instance is the result, afterwards becomes a cause of the disease, which it keeps up by preventing the tissues from approximating and uniting. Swelling and extravasated blood are met with in the perineum after contusions. These collections of blood are usually situated in the subcutaneous cellular tissue; but it is not uncommon to find them more deeply seated, either between the two layers of the superficial fascia, or between the deep fascia and the superficial aponeurosis. When they are subcutaneous, they are often confined to either the right or left side, not being able to pass beyond the raphé of the perineum in consequence of the adhesion of the skin at this part to the cellular tissue. On the contrary, when they are deeper seated, either between the two layers of the fascia, or immediately in front of the superficial aponeurosis, they often form a projection in the median line, and easily pass from one side to the other, there being no partition between them. These remarks apply equally to collections of pus, serum, urine, or gas, as to effusions of blood.

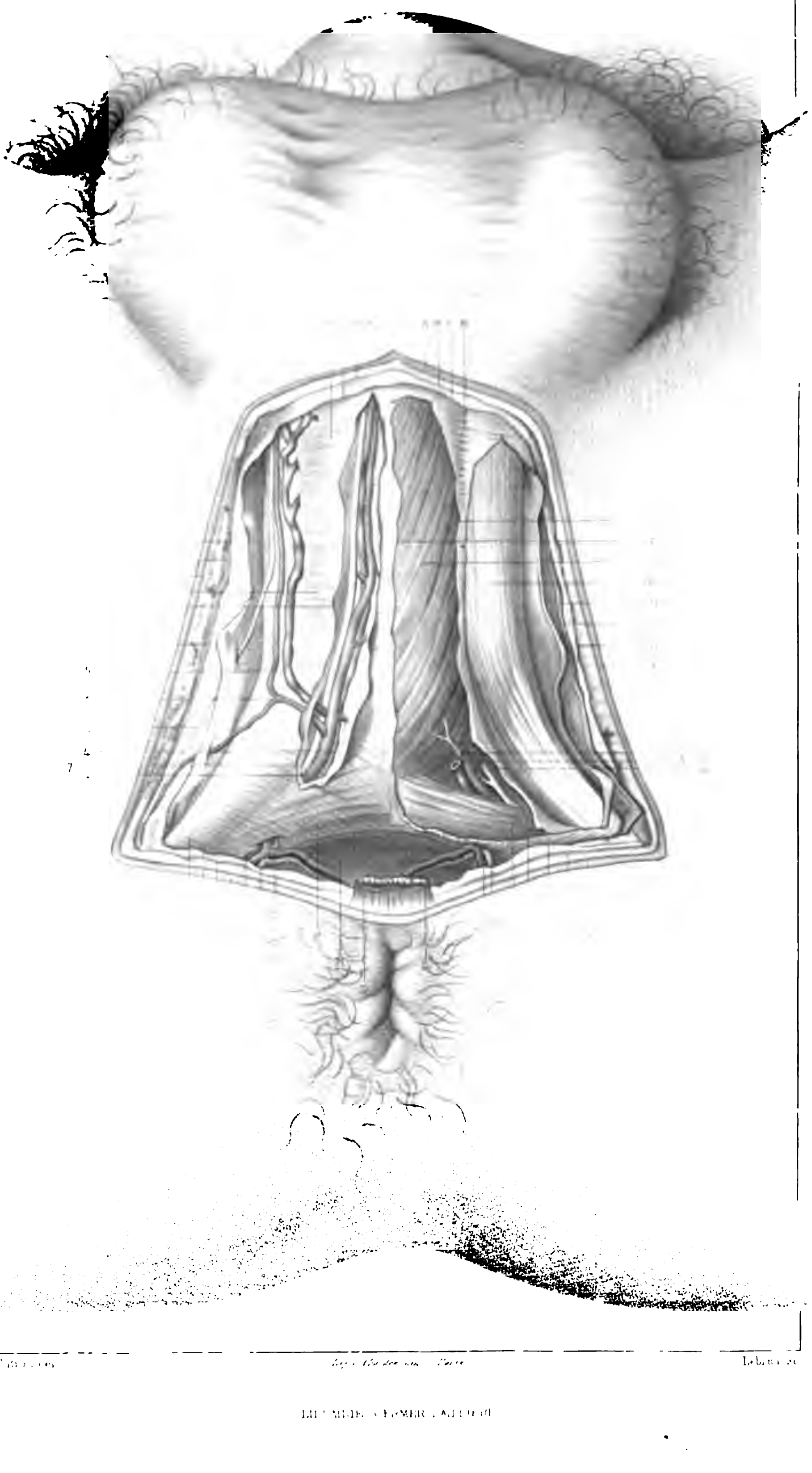
Ulcerations of all kinds are met with in the perineum, the most common are syphillitic. Soft or indurated chancre, mucous tubercles, syphillitic cutaneous eruptions are frequent in consequence of the proximity of the genital organs; these diseases behave here as elsewhere, with the exception of indurated chancres, which become very prominent, probably in consequence of the number of muscular fibres and the great thickness of the skin.

Organic diseases, such as cancer, are developed secondarily, generally commencing on the scrotum, or at the anus. Various tumours are situated in the perineum, amongst them we may mention acne, mucous tubercles, indurated chancres, elephantiasis, cysts, and the various collections of liquids or gases which we have previously mentioned.

In regard to operative surgery, the first layer is equally important. As the skin is covered with hair, this must necessarily be shaved off whenever an operation is performed in the region. There are several advantages in commencing in this way; the knife is not impeded by them, the form of the region is better appreciated, the points of reference and the raphé are more easily recognised, and lastly, the hair cannot become interposed between the margins of the wound and prevent their uniting. It may be observed that the skin presents in the whole of the median line a ridge forming what is termed the *raphé of the perineum*. This ridge forms a guide in the operations for lithotomy; thus, in the median operation, the incision is carried along it; in the lateral operation it is directed parallel to it; while in the lateral operation, as it is usually performed, the incision commences at the raphé three centimetres (1·18 English inch) in front of the margin of the anus, and is carried obliquely outwards and backwards towards the tuberosity of the ischium; lastly, the incision is sometimes made transversely, that is, perpendicularly to the raphé, so that in fact the incision has been made in nearly every direction. No danger attends any of these incisions in the layer with which we are occupied, because there is no vessel of sufficient size to give rise to hæmorrhage, or organs of sufficient importance between the skin and the superficial aponeurosis that their being wounded would endanger life. But it is not so at a greater depth, and in this respect we shall have to point out dangers which may accompany each of these incisions.

In regard to incisions and wounds which only involve the superficial layers, we may observe that they are attended with very little danger. We have already said this is owing to the circumstance that the knife does not encounter any large vessel or any important organ. The superficial vessels are too small to cause hæmorrhage. Yet as the nerves are numerous, we can understand that the pain will be very acute whenever the superficial layers are concerned. The skin forms the outermost layer, and possesses great plastic and contractile properties; the subjacent tissues partake of these properties in a less degree; wounds of the perineum easily assume a conical form, having the apex placed inwards, while the base corresponds to the skin. This arrangement is very favourable to the process of cicatrisation. It must also be remembered that the skin being very elastic and moveable over the subjacent layers, especially at the anterior and posterior boundaries of the region, it sometimes becomes depressed, so that the incision presents at these same points a kind of *cul de sac;* in a word, the skin should be incised to the same extent as the subjacent tissues, if we would avoid having a collection of fluid in these depressions, which frequently become the centre of dangerous infiltrations, especially after the operation for stone.

Further, as the region of the perineum is only fully developed when the thighs are separated, it is only in this condition that wounds of it remain open; it is sufficient to bring the thighs together to convert the region into a kind of groove, so that the edges of the wound are placed in apposition. We may take advantage of this, and if the wound is superficial, by bringing the thighs together we may do away with the necessity of applying a suture; if, on the contrary, the wound is a deep one, such, for instance, as is made in the different operations for stone, or for the evacuation of a collection of fluid, the approximation of the thighs will be contraindicated, because under these circumstances it would evidently prevent the escape of the fluid it is intended to discharge. Yet, as it would sometimes be very distressing and even impossible for the patient to retain this position, we obtain the same result by placing a drainage tent in the wound, keeping at the same time the thighs partially open.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XLI.

Perineal Region in the Male.

Second layer.

EXPLANATION.

RIGHT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. Section of the fibres of the external sphincter muscle of the anus.
E. Superficial aponeurosis of the perineum covering the accelerator, urinæ and erector penis muscles.
F. Superficial aponeurosis of the perineum reflected over the posterior edge of the transverse muscle of the perineum after having covered the superficial surface of the same muscle.
G. Opening in the superficial aponeurosis of the perineum to show the superficial vessels and nerves, which are contained in a sheath formed by the reflection of this same superficial aponeurosis of the perineum.
H. Aponeurosis of the sphincter muscle of the anus continuous with the superficial aponeurosis of the perineum behind the transverse muscle (ano-perineal aponeurosis of M. Velpeau).

1. Trunk of the superficial perineal artery.
2. External branch of the superficial perineal artery.
3. Anal branch of the superficial perineal artery.
4. Superficial perineal vein.
5. External branch of the superficial perineal vein.
6. Vein coming from the region of the anus and emptying itself into the superficial vein of the perineum.
7. Trunk of the superficial perineal nerve accompanying the superficial vessels of the region.
8. Nerves accompanying the vessels distributed to the region of the anus.
9. Nervous branch coming from the small sciatic nerve.

LEFT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. Section of the external sphincter muscle of the anus.
E. Superficial aponeurosis of the perineum.
F. Section of the superficial aponeurosis of the perineum to show the accelerator urinæ muscles.
G. Septum interposed between the erector penis and the accelerator urinæ muscles furnished by the superficial aponeurosis of the perineum.
H. Section of the superficial aponeurosis of the perineum showing the interior of the sheath which it furnishes to the erector penis muscle.
I. Section of the superficial aponeurosis showing the transverse muscle of the perineum.
J. Fibres of the accelerator urinæ muscle.
K. Fibres of the erector penis muscle.
L. Transverse muscle of the perineum (superficial portion of the muscle).

1. Section of the superficial perineal artery.
2. Anal branch of the superficial perineal artery.
3. Section of the superficial perineal vein.
4. Section of the superficial perineal nerve.
5. Anal branch furnished by the superficial perineal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

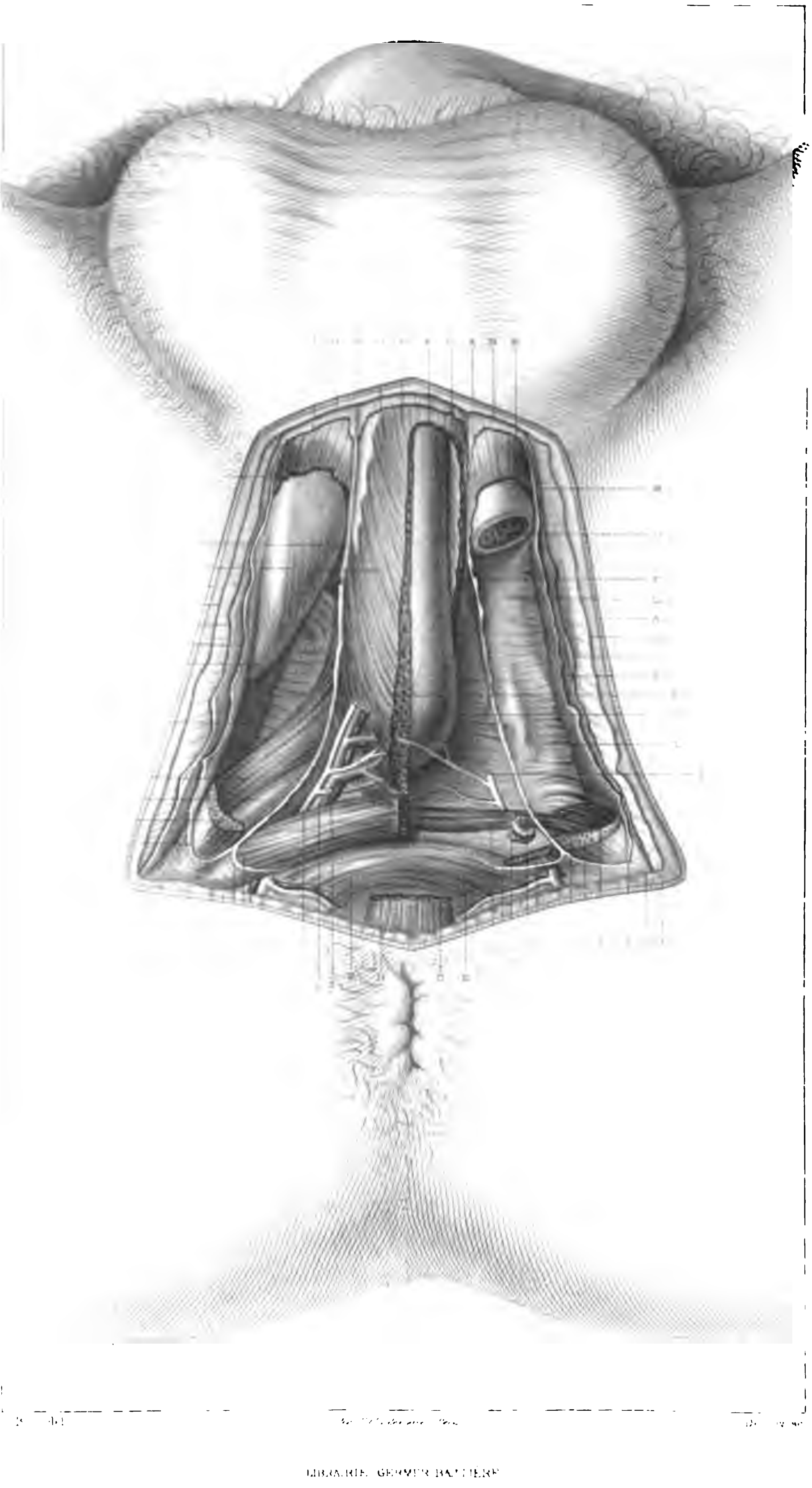
The middle portion of the perineum which forms our second layer includes a large number of organs, whose relative positions and importance should be thoroughly understood by the surgeon In this division, placed between the superficial and middle aponeuroses, we find in the median line the accelerator urinæ muscle and the urethra, which it covers, as well as some of the fibres of the sphincter muscle of the anus ; at the lateral parts, the erector penis and the roof of the corpus cavernosum, behind the transverse muscle of the perineum and the anterior fibres of the sphincter muscle of the anus : lastly, in the midst of these organs we see the vessels and nerves, and on each side of the urethra the glands of Merg, also called Cowper's glands, but incorrectly, as shown by M. Gubler in his inaugural thesis. It is sufficient to examine this Plate to see at once that the perineum is divided into two perfectly symmetrical regions separated from each other by a median septum. There is, in fact, a complete separation between the right and left sides by means of a fibrous partition which passes from the deep surface of the superficial aponeurosis to the anterior surface of the middle aponeurosis by passing round the accelerator urinæ in front, and the transverse muscle behind. Hence diseases which occupy this portion of the region will be circumscribed by this partition ; there is, therefore, a large space on the right and left sides, and also in the centre The middle space encloses the urethra, the glands of Merg, and the accelerator urinæ muscle, and it is into this space that the urine spreads when there is a rupture of the urethra in front of the middle aponeurosis. This infiltration is recognised by the presence of a swelling which will be circumscribed in the median line, but easily extends forwards towards the base of the scrotum, while posteriorly it will be limited by the aponeurosis covering the transverse and sphincter ani muscles The lateral space is sub-divided into two smaller spaces, which contain, one the erector penis muscle and the root of the corpus cavernosum, the other the transverse muscle of the perineum as well as the transverse muscle of the urethra *(transverso-urethral)*, and the transverse muscle of the bulb *(transverso-bulbaire)*, which are in some respects offshoots of the first muscle. Each lateral space forms a triangle, of which the apex is anterior and the base posterior ; the external side is bounded by the ischio-pubic branch, and the internal side by the erector penis muscle, or by the median line. This triangle in its turn encloses another triangle or fibro-cellular space, which it is important to be acquainted with, inasmuch as it contains the superficial vessels and nerves at the moment of their sub-dividing. This triangle is situated at the posterior part of the region in front of the transverse muscle, internal to the erector penis muscle, and external to the accelerator urinæ muscle.

After this general examination of the region and of the present Plate, we are in a position to estimate the relative advantages of the different operations for lithotomy. With regard to the median operation, it is evident the knife will not meet with any important organ in the median line; in fact, it will only involve the superficial aponeurosis, the partition which it detaches from its deep surface, the erector penis muscle, and at a greater depth the bulb of the urethra, as may be seen in the following Plate. Thus, there is no vessel capable of affording any considerable quantity of blood, and this is the advantage of this method; let us see what are its disadvantages. If the incision is made at ever so short a distance from the median line, we see by this Plate that it is very easy to open the veins and arteries coming from the superficial vessels of which they are the principal branches, and proceed throughout the whole of the region within a few millimetres of the median line; these vessels are of such a size as to give rise to a hæmorrhage that is at least sufficient to prevent the operator from dividing the deeper structures, so that he often will be obliged to apply a ligature to these vessels before proceeding further. It must also be understood that the median incision necessarily includes the bulb of the urethra. In old persons this organ being very vascular may furnish a large quantity of blood, which either oozes out or comes away in a continuous stream, which it is very difficult to arrest on account of the depth at which the vessels are situated from which it escapes. If to this it is added that these vessels very readily become inflamed and give rise to a purulent discharge, we can understand why the older surgeons were opposed to these incisions in the median line, which are, in fact, very dangerous. In our opinion this incision, and therefore the median operation, termed *apparatus major*, ought only to be employed in children, in whom the bulb is less vascular, and may thus escape all these dangers.

The lateral operation seems to be even more dangerous. In fact, in this operation the incision is performed at the side parallel to the median line, some millimetres external to it. Such an incision will involve the internal branches of the superficial vessels of the perineum. Those vessels will even be divided in the direction of their length, and the opening will have an oblique direction, so that it will be more difficult to arrest the flow of blood. We will here mention an anatomical fact, which is that these vessels, as any one may satisfy himself, are not in the subcutaneous layer as is stated, but on the contrary are situated in the thickness of the middle aponeurosis, which is folded over so as to form a sheath for them. We are inclined to admit that this sheath communicates with the interior of the pelvis by means of the sheath of the internal pudic vessels, and enclosing a large quantity of fat, serves to convey externally any urinous or purulent infiltrations which may arise in the cavity of the pelvis.

The modification of the lateral operation in which an oblique incision is carried from before backwards and from within outwards, necessitates the division of the superficial perineal vessels and nerves at the point of their emergence into the region and into that part with which we are now occupied. This is the only disadvantage of this incision, and is common to it and to the two previous operations, but as the operation does not involve the bulb of the urethra it is to be preferred to either of the others.

Pre-rectal lithotomy, proposed by M. Nélaton, and performed by this distinguished surgeon with the greatest success, appears to us to be free from all these objections. This incision passes from right to left, commencing two centimetres (1.18 English inch) in front of the anus; it does not wound any important part neither in the first layer or in the second, which we are now examining; it passes successively through the skin, the two layers of the superficial fascia, the superficial aponeurosis, the anterior and superficial fibres of the sphincter muscle of the anus, and the fibres of the transverse muscles of the perineum; it therefore avoids the vessels of the region, as well as the bulb of the urethra. We find that it possesses only one inconvenience, and that is, that the inexperienced surgeon might wound the urethra, and this happens more easily on account of the straining on the part of the patient, who thus brings the rectum forwards in the course of the wound; but this danger is easily avoided by watching the movements of the patient, and especially, if when the knife is used, the finger is placed in the rectum so as to ascertain how far this organ is off. In a word, it is the lateral, and more particularly the pre-rectal operations which in this region possess the greatest advantages and are attended with the least inconvenience.



LIBRAIRIE GERMER BAILLIERE

PLATE LXII.

The Perineal Region in the Male.

Third layer.

EXPLANATION.

RIGHT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia.
D. Section of the external sphincter of the anus.
E. Deep circular fibres of the sphincter of the anus.
F. Muscular fibres of the accelerator urinæ muscle.
G. Section of the aponeurosis of the accelerator urinæ muscle formed by the superficial aponeurosis of the perineum.
H. Section of the erector penis muscle.
I. Muscular fibres of the erector penis going to be inserted into the bulb of the urethra.
I′. Superior fibres of the erector penis muscle going to be inserted into the lateral surface of the bulb of the urethra and at the same time into the aponeurotic partition which separates the erector penis and the accelerator urinæ muscles.
J. Section of the aponeurosis of the accelerator urinæ formed by the superficial aponeurosis of the perineum.
K. Middle aponeurosis assisting to form the sheath of the accelerator urinæ muscle.
L. Aponeurotic partition separating the erector penis and accelerator urinæ muscles.
M. Superficial portion of the transverse muscle of the perineum.
N. Section of the aponeurosis of the transverse muscle of the perineum.
O. The crus of the corpus cavernosum inserted into the ascending branch of the ischium.

1. Superficial artery of the perineum furnishing branches to the bulb of the urethra.
2. Branch of the superficial artery of the perineum going to the region of the anus.
3. Superficial veins of the perineum.
4. Anal vein.
5. Superficial nerves of the perineum.

LEFT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
C. Section of the second layer of the superficial fascia inserted into the ischio-pubic ramus.
D. Section of the anterior fibres of the external sphincter muscle of the anus.
E. Circular fibres of the sphincter muscle of the anus covered by their aponeurosis.
F. Section of the erector penis muscle.
G. Section of the aponeurosis of the accelerator urinæ muscle.
H. Section of the erector penis muscle.
I. Section of the superior fascia of the erector penis muscle.
J. Inferior and deep fascia of the erector penis muscle going to be inserted into the urethra and into the median line (ischio-urethral or bulbus muscle).
K. Section of the aponeurosis of the erector penis muscle.
L. Middle aponeurosis forming the deep layer of the sheath of the erector penis muscle.
L′. Sheath of the erector penis muscle enclosing the crus of the corpus cavernosum.
M. Section of the transverse muscle of the perineum (superficial fibres).
N. Section of the aponeurosis of the transverse muscle of the perineum.
O. Section of the crus of the corpus cavernosum.
P. Bulb of the urethra.

1. Section of the superficial perineal artery.
2. Section of the superficial vein of the perineum.
3. Section of the superficial nerve of the perineum furnishing filaments to the erector penis and to the bulb of the urethra.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

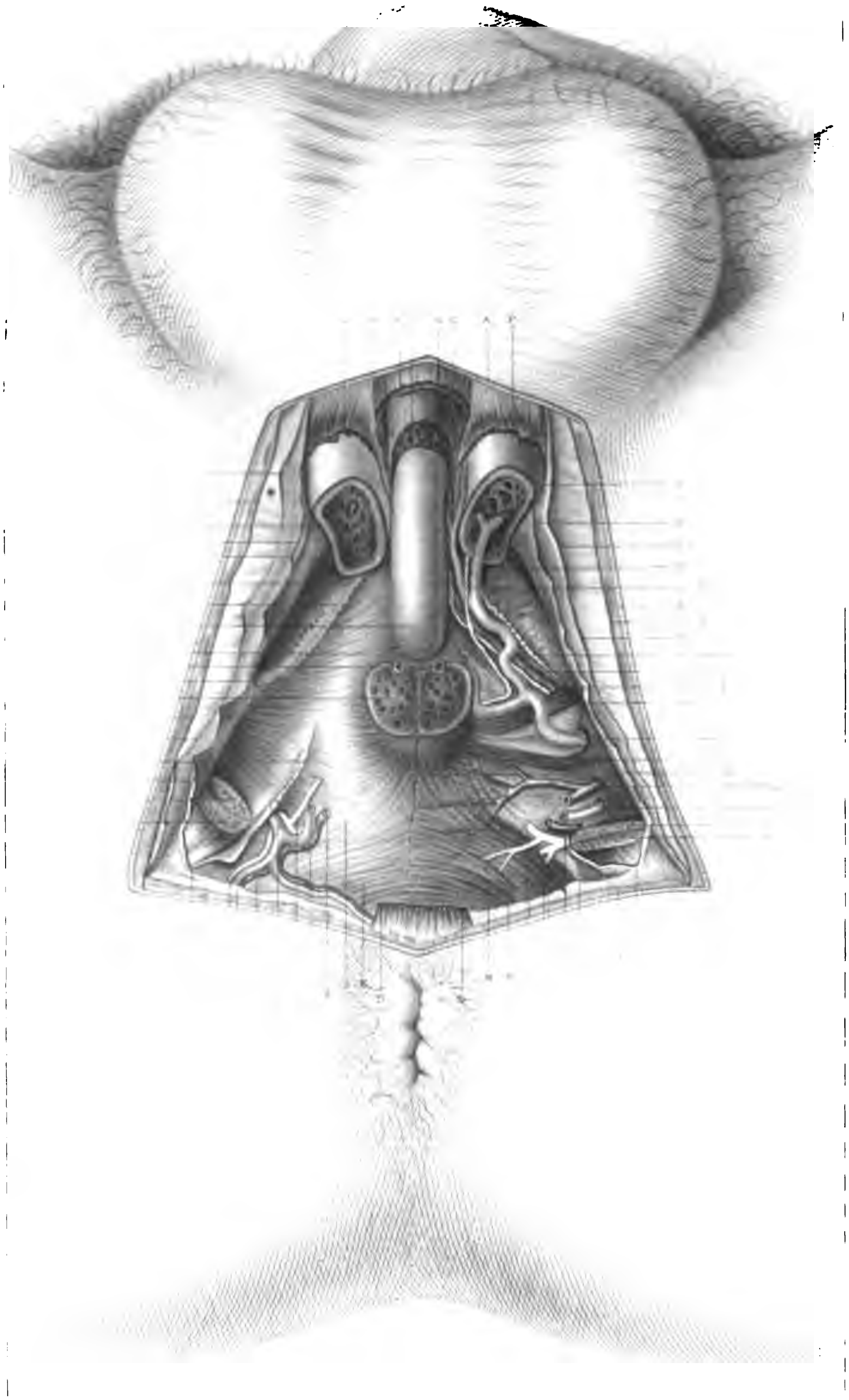
This Plate supplies us with useful information in relation to pathology. Thus the relations of the urethra with the symphysis pubis clearly explain how in the case of a fall on the perineum, the urethra may be torn and give rise either to hæmorrhage from the urethra, or to an infiltration of urine. A simple examination of the drawing shows that the laceration will occur in front of the bulb, from thence the urine will become infiltrated between the superficial and middle aponeuroses of the perineum into the very sheath of the accelerator urinæ muscle, and advancing along the corpora cavernosa will show itself beneath the skin, raising it up from off the corpora cavernosa, proceeding from behind forwards. I witnessed such a case some years ago during my attendance at the Hôpital Saint Antoine, and was so fortunate as to see the skin become reunited to the corpora cavernosa. The great vascularity of the corpora cavernosa of the penis and urethra, of the bulb with the arteries and veins which pass to and from it, sufficiently account for contusions or wounds of the penis being followed by an effusion of blood, sometimes to a very considerable extent, or by hæmorrhage from the wound, or from the urethra when the injury reaches the corpus spongiosum of the urethra. Infiltrations of blood are governed by the same rules as those we have already explained in regard to infiltrations of urine or of pus, that is to say, they are limited by the aponeurotic layers. An examination of the different layers as represented in these Plates is sufficient to enable us to arrive at these simple conclusions, so that it is unnecessary to repeat them on the present occasion.

With regard to operative surgery we shall have to speak of opening the urethra, of the operation for stone, and of amputation of the penis.

Very often when a large calculus is imparted in the urethra, or when there is an impassable or undilatable structure, we are compelled to open the urethra by an incision in the perineum. This incision has received the name of *boutonnière* (button-hole). If we wish to arrive directly at the urethra, we can only do so after having overcome many difficulties, because this soft and extremely flexible organ escapes as it were from our pursuit. The surgeon overcomes this difficulty by previously introducing a grooved staff, which clearly points out the situation and direction of the canal, and serves to guide the knife by means of the groove. When there is a large calculus impacted in the urethra, the presence of the stone is shown by a distinct enlargement in the region of the perineum, and may guide the knife with as much precision as the grooved staff. I proceeded in this way in the removal of a large stone retained in the spongy portion of the urethra in front of the bulb. I was able to extract the stone by the perineal region and remedy the injurious effects of the infiltration of urine which had been caused by it.

In this Plate is seen the exact situation of the bulb of the urethra in front of the middle aponeurosis of the perineum. It is the organ which must be most especially avoided in every operation for stone; if it is wounded, the operation is rendered doubly hazardous from hæmorrhage and phlebitis. In the median operation it is dangerously wounded, and therefore in this respect that operation is bad, and it is useless to urge in its behalf that the incision is only carried along the median line of the bulb and of the corpus spongiosum, a part where the vascularity is not so great. In the lateral operation there is still considerable danger of its being wounded, or at all events the large vessels which reach it from the side; this plan should therefore be rejected because of this serious inconvenience. The modification of the lateral operation, which has been previously described, the unilateral or the bilateral operation place the surgeon in a favourable condition to avoid injuring the bulb; but there are certain conditions which may lead us to fear this complication. Thus, for instance, in old men, or even in persons who have long suffered from disease of the urinary organs, the bulb becomes turgid, more voluminous, gets nearer to the rectum, so that the distance of three centimetres (1·18 English inch), which normally exists between the anus and the bulb, is reduced to two centimetres (·797 English inch), and to even less than that. It is evident that unless we were previously acquainted with this change of position, the bulb would be wounded. The modification of the lateral operation, therefore, still presents a serious inconvenience. Lithotomy from the perineum is here, as in the other layers, the operation which best avoids this complication. In fact, by making a transverse incision in the region one centimetre (·393 English inch) in front of the anus, and by following the anterior wall of the rectum, which is raised up by means of the finger introduced into the canal, and can be recognised by the direction of its inferior circular fibres, we separate it as far as possible from the bulb, and avoid, as surely as possible, wounding this organ.

With respect to amputation of the penis, we see from examining the region that the operation is dangerous in proportion as it is performed near to the middle aponeurosis of the perineum; this arises not only from the great chance there is of infiltration of urine, but also from the greater liabilty there is to hæmorrhage.



P. Bion del.

LIBRAIRIE GERMER BAILLIÈRE

PLATE LXIII.

Perineal Region in the Male.

Fourth Layer.

EXPLANATION.

RIGHT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia continuous with the fascia of the thigh.
C. Section of the second layer of the superficial fascia inserted into the ischio-pubic ramus.
D. Section of the external sphincter muscle of the anus.
E. Deep circular fibres of the sphincter ani covered by the middle aponeurosis of the perineum.
F. Section of the accelerator urinæ muscle.
G. Section of the erector penis muscle.
H. Section of the deep fibres of the erector penis muscle going to be inserted on to the side of the bulb of the urethra.
I. Section of the aponeurosis of the erector penis muscle.
J. Aponeurotic partition separating the accelerator urinæ and the erector penis muscles and inserted into the inferior surface of the middle aponeurosis of the penis.
K. Section of the posterior part of the bulb of the urethra.
L. Section of the middle part of the bulb of the urethra.
M. The urethra after it has passed through the middle aponeurosis of the perineum.
N. Section of the root of the corpus cavernosum.
O. Posterior extremity of the sheath of the corpus cavernosum.
P. Partition separating the corpus cavernosum from the accelerator urinæ muscle and giving insertion to the fibres of the middle aponeurosis of the perineum.
Q. Ascending branch of the ischium giving insertion to the root of the corpus cavernosum.
R. Pearly fibres of the middle aponeurosis of the perineum going to surround the urethra.
S. Fibres of the middle aponeurosis of the perineum going from the bulb of the urethra to the muscular fibres of the internal sphincter of the anus.

1. Trunk of the superficial artery of the perineum.
2. Section of the trunk of the superficial perineal artery.
3. Section of the branch going to the bulb from the superficial perineal artery.
4. Section of the artery of the corpus cavernosum furnished by the internal pudic.
5. Posterior branch of the superficial perineal artery.
6. Superficial veins of the perineum.
7. Posterior venous branches.
8. Trunk of the superficial perineal nerves.
9. Posterior branch of the superficial perineal nerve.

LEFT SIDE.

A. Section of the skin bounding the region.
B. Section of the first layer of the superficial fascia.
O. Section of the second layer of the superficial fascia.
D. Section of the external sphincter muscle of the anus.
E. Section of the accelerator urinæ muscle.
F. Section of the erector penis muscle.
G. Section of the deep fibres of the erector penis muscle.
H. Section of the aponeurosis of the erector penis muscle.
I. Deep fibres of the erector penis muscle, situated below the middle aponeurosis and going from the ischium to the bulb of the urethra (anterior erector muscle of the penis).
J. Other muscular fibres going from the ischium to the lateral and posterior surface of the bulb of the urethra (posterior erector muscle of the penis).
K. Muscular fibres of the internal sphincter going to be inserted into the posterior bulb of the urethra.
L. Section of the aponeurosis of the internal sphincter of the anus.
M. Section in the median line of the middle aponeurosis of the perineum.
N. Section of the bulb of the urethra.
O. Section of the corpus cavernosum.
P. Cavity of the corpus cavernosum.

1. Deep artery of the perineum, the termination of the internal pudic.
2. Section of the superficial and transverse artery of the perineum.
3. Internal pudic vein.
4. Transverse vein of the perineum.
5. Superficial vein of the perineum.
6, 7, 8. Lymphatic vessels.
9. Section of the superficial nerve of the perineum.
10. Branch furnished to the anus by the superficial nerve of the perineum.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In this Plate is seen the deep organs situated in the middle layer of the perineum in man, together with the middle aponeurosis of the perineum forming the superior boundary of this portion; this aponeurosis establishes a separation between the organs within the pelvis and those without. By its thickness and extent, this aponeurosis also establishes a line of demarcation between diseases in the interior of the pelvis and those which are more superficial. This fibrous membrane is perforated towards the centre to allow of the passage of the uretha, behind this opening is the bulb of the urethra, which is intimately united to the middle aponeurosis, in front of which it is applied and maintained by aponeurotic and muscular fibres which radiate from the ischio-pubic ramus, and may be spoken of under the name of the *ischio-bulbus muscular fibres*. Other fibres derived from the sphincter ani go to the bulb and should be designated as the *ano-bulbus* fibres. We may distinguish very readily on each side of the region the spaces for the ischio-cavernous, bulbo-cavernous, and transverse muscles of the perineum.

We would especially call the attention of the surgeon to the vessels occupying the middle layer of the region. First there are the superficial vessels of the perineum derived from the internal pudic artery and protected at their origin by the transverse muscle of the perineum. This situation therefore exposes them to the danger of being wounded at their point of emergence. In the lateral operation for stone, they cannot be reached at this point, nor in the modification of the lateral operation, and still less in the pre-rectal operation.

A little higher and towards the middle of the region, a large artery is seen to reach the middle layer passing between two sets of fibres belonging to the ischio-bulbus muscle.* This artery supplies both the bulb of the urethra and the corpus cavernosum of the penis. It is of sufficient size at its commencement to cause a profuse discharge of blood when wounded. Fortunately from its deep position and the effectual protection it receives from the muscles, the aponeuroses, and from the corpora cavernosa which are in front of it, it escapes being wounded. Its trunk cannot be wounded in any perineal operation for the stone. A branch of it, however, which goes to the bulb may be divided in the lateral operation, and here it is of sufficient size to give rise to such a hæmorrhage as is not unattended with danger. This is an additional reason for entirely rejecting the lateral operation for stone.

It must be observed that the vein which comes from the corpora cavernosa does not exactly follow the course of the artery which I have now described, and does not like that pass in a fibrous sheath between the vessels of the muscles; it appears, in fact, to avoid all compression, and it is no doubt for this reason that it enters the pelvis above the superior ischio-bulbus fibres.

With regard to the internal pudic artery, it does not at present belong to the middle layer of the perineum, it is placed below the ischio-pubic ramus and is concealed by the middle aponeurosis, so that it is very rare for it to be wounded. It has been said that it might be divided in operating for stone. I think that is almost impossible in any of the operations. It is certainly only in the modification of the lateral operation that this accident could occur, and then it could not happen with the *lithotome cachée*. We must therefore account for the hæmorrhage which takes place after these operations, not from the internal pudic artery being wounded, but one of its branches, principally that of the bulb and the superficial perineal artery near its origin.

From this it is seen that the internal pudic artery does not require to be tied so often as some persons represent. If this operation is necessary all the guides for its performance will be found by examining the four Plates illustrating the perineum in man. An incision should be made parallel to the ischio-pubic ramus to the extent of seven or eight centimetres (2·75 to 3·14 English inch). We shall thus pass successively through the skin, the subcutaneous tissue, the two fascias, and arrive at the middle aponeurosis. There we shall meet with the accelerator urinæ muscle, which must be separated from its attachments to the ischio-pubic ramus; it is to be partially detached from the bone when we reach the middle aponeurosis, in front of which is the artery of the corpus cavernosum. A grooved director is introduced into the opening through which the artery passes out, and the aponeurosis is divided from above downwards, beneath which we find the artery as we approach the tuberosity of the ischium. A blunt-pointed tenaculum may be advantageously employed to draw out the artery. If we cannot control the hæmorrhage by this operation, a valuable resource remains in the use of plugging, always supposing that it has not been previously employed.

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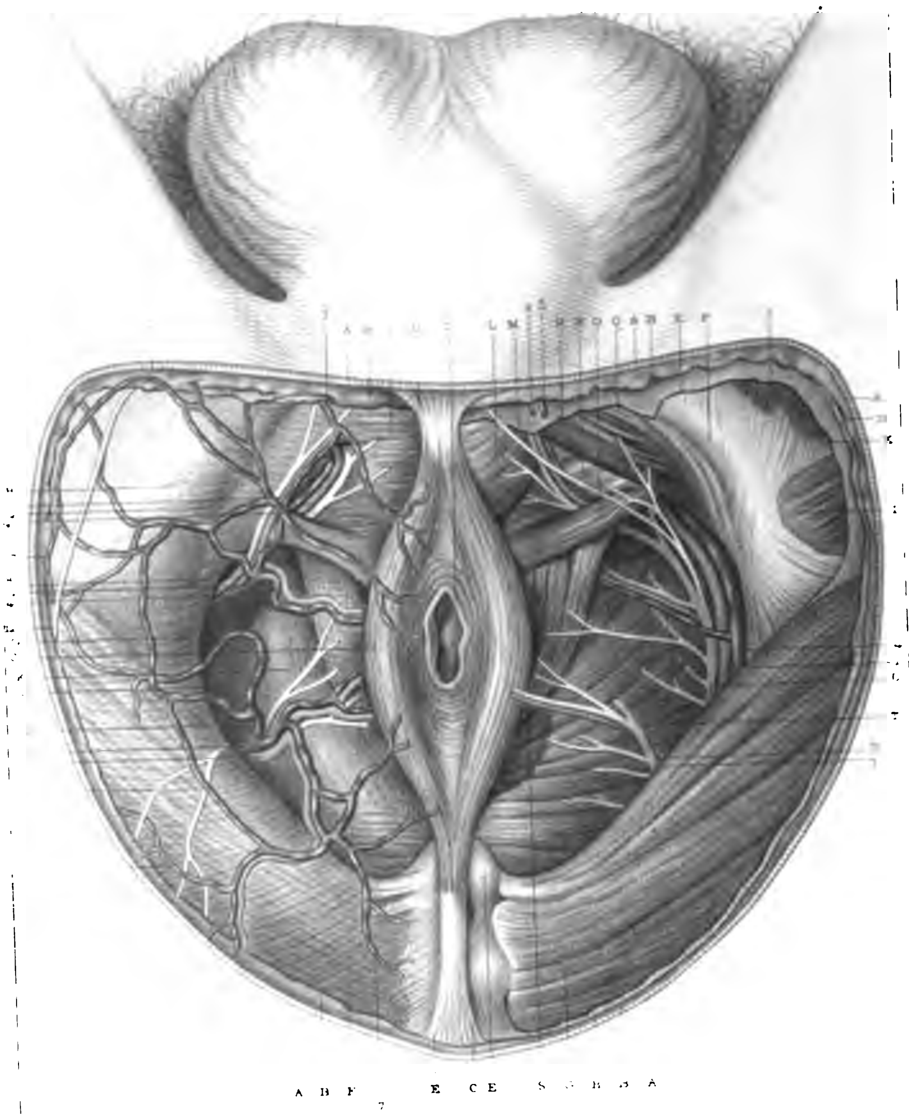
* M. Jarjavay has given this name to fibres which are occasionally met with in the ischio-bulbus triangle.—*Trans.*



LIBRAIRIE GERMER BAILLIERE

PLATE LXIV.

Region of the Anus.

EXPLANATION.

RIGHT SIDE.

A. Section of the skin bounding the region.
B. Superficial fascia and fatty subcutaneous cellular tissue.
C. External sphincter muscle of the anus.
D. Anterior insertion of the external sphincter muscle of the anus along the raphé and into the superficial fascia of the perineal region.
E. Posterior insertion of the external sphincter muscle of the anus into the apex and posterior surface of the coccyx.
F. Aponeurosis covering the glutæus maximus muscle.
G. Fibres of the aponeurosis of the glutæus maximus going to be inserted into the tuberosity of the ischium.
H. Aponeurosis of the thigh inserted into the ischio-pubic branch.
I. Superficial aponeurosis of the perineum covering the accelerator urinæ and the erector penis muscle.
K. Aponeurosis covering the levator ani muscle, forming the internal wall of the ischio-rectal fossa.

1. Superficial artery of the perineum furnished by the internal pudic.
2. Another branch coming from the internal pudic and traversing the superficial aponeurosis.
3. Branch of the internal pudic ramifying around the anus.
4. Superficial ramification of the internal pudic vein.
5. Internal pudic artery.
6. Venous trunk receiving the veins from around the anus.
7. Vein establishing an anastomosis between the superficial veins of the glutæal region and the internal pudic vein.
8. Superficial nerve of the perineum.
9. Internal branch of the superficial nerve of the perineum.
10. Branches of the internal pudic nerve going to be distributed to the muscles of the skin of the anal region.
11. External branches of the pudic nerve going to the skin of the glutæal region.
12. Branch of the small sciatic nerve distributed to the perineal region.

LEFT SIDE.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Tendon of the external sphincter muscle of the anus.
D. Section of the mucous membrane of the anus.
E. Terminal extremity of the coccyx.
F. Aponeurosis of insertion of the internal muscles of the thigh.
G. Glutæus maximus muscle.
H. Aponeurosis of the glutæus maximus.
I. Muscles which are inserted into the ischium.
J. Adductor muscles of the thigh.
K. Femoral aponeurosis.
L. Accelerator urinæ muscle.
M. Superficial aponeurosis of the perineum.
N. Superior fibres of the transverse muscle of the perineum.
O. Inferior fibres of the transverse muscle of the perineum.
Q. Inferior insertion of the erector penis muscle.
R. Section of the superficial aponeurosis of the perineum.
S. Internal fibres of the levator ani muscle.
T. External and middle fibres of the levator ani muscle.

1. Internal pudic artery.
2. Section of the superficial artery of the perineum.
3. Anal artery, a branch of the internal pudic artery.
4. Internal pudic vein.
5. Section of the superficial vein of the perineum.
6. Internal pudic nerve.
7. Anal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

There are few regions of the body which abound more in practical applications than that of the anus. Inflammations, suppurations, ulcerations, fistulæ, and tumours of all kinds occur within this limited space. Not only do these various disorders arise in the different tissues, but the latter form, so to speak, a common centre of union to several parts of the body; hence there are idiopathic affections, and symptomatic affections proper to the anal region.

The inflammations are of various kinds, sometimes simple and sometimes specific. The presence of both is explained by the delicacy of the skin, which possesses nearly all the characters of a mucous membrane, by the secretions which constantly lubricate it, and easily decompose, by the residue of the fœcal matters which may remain in it, and lastly, by the numerous folds around the margin of the anus, which seem intended to retain all the products of secretion or of excretion, and thus favour the development of erythematous, exanthematous, or erisepelatous inflammation, or even of phlegmonous inflammation.

The large quantity of subcutaneous cellular tissue, together with its tenuity and laxity, readily accounts for the facility with which phlegmonous inflammations occur, and for the formation of abscesses, which like the inflammations may occupy various positions according to the tissue attacked, and the depth at which they are placed.

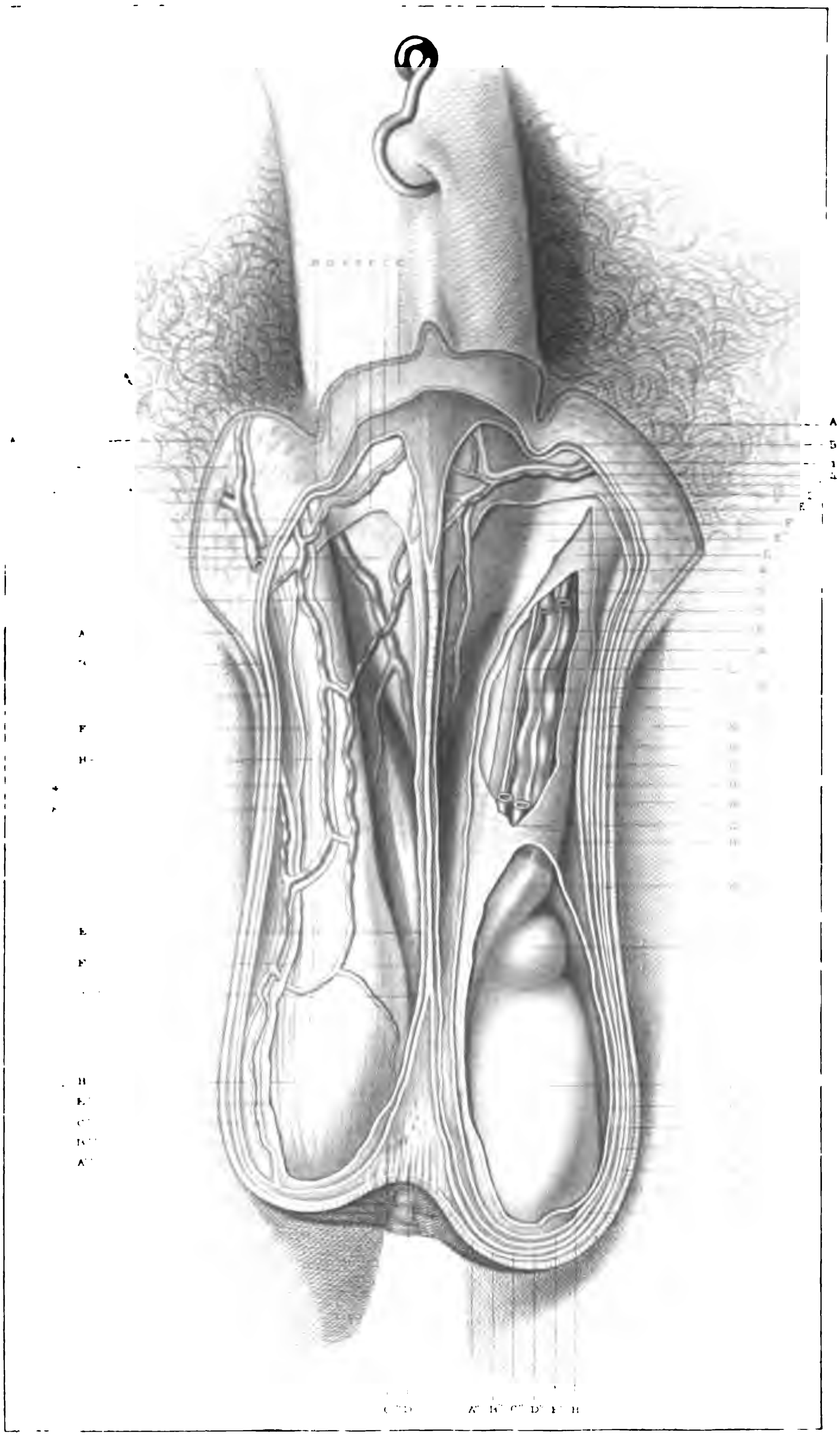
A cursory examination of the region is sufficient to convince us that these inflammations and abscesses of the margin of the anus should be distinguished into several varieties according to their anatomical positions. We distinguish the following: 1. inflammations and abscesses occupying the skin and the sudoriferous or sebaceous glands, which are here very numerous; 2. inflammations and abscesses immediately beneath the skin—subcutaneous; 3. inflammations and abscesses beneath the muscles or the mucous membrane; 4. inflammations and abscesses occupying the ischio-rectal fossa; 5. inflammations and abscesses which come from the deeper parts, and which are often symptomatic of some disease of the intra-pelvic organs, or of the vertebral column.

The distinctions we have established are not merely theoretical but are of great practical value in regard to prognosis and treatment. Thus, abscesses which occupy the skin, the subcutaneous cellular tissue, or even the muscular tissue readily heal either spontaneously or by making a simple incision; but it is not so with abscesses beneath the mucous membrane, or with those which occupy the ischio-rectal fossa. Abscesses at the margin of the anus situated beneath the mucous membrane, and which communicate with the inferior extremity of the rectum, are seldom cured by the unaided resources of nature, for the following reasons. When pus has raised up the mucous membrane and made a course for itself towards the skin at the margin of the anus, it forces the cellular tissue aside and produces a separation of the skin as it had previously done of the mucous membrane; the consequence is that the two tegumentary membranes already wasted away, being still further reduced by the distension on the one hand, and by the want of nutrition on the other, cannot become reunited to the subjacent tissues. Other circumstances contribute to this result, such as the entrance of fœcal and gaseous matters into the superior opening of the abscess and the friction and irritation caused by every act of defecation The consequence is that these abscesses continue for an indefinite time, and are then termed *fistulæ*. The fistulæ themselves receive different names, they are spoken of as *complete fistulæ* and *incomplete fistulæ*. The latter are *blind external fistulæ* when there is a single orifice opened on to the surface of the skin, or *blind internal fistulæ* when there is a single opening in the rectum. Both of these present varieties according as they are placed beneath the *skin* or the *mucous membrane*, *within* the sphincter, or *external* to the sphincter. All these varieties of fistulæ do not heal up because the fold of skin or mucous membrane which covers them prevents the formation of granulations. To obtain a cure it is sufficient to destroy this cutaneous or mucous fold. For this purpose we employ the knife, the ligature, or the ecraseur, and sometimes excision. The application of the dressing is of great importance, it should be carried to the bottom of the wound made by the operation. In general the operation is not attended with hæmorrhage because there are no important vessels in the neighbourhood. Sometimes, however, we meet with anal fistulæ whose superior orifice is placed at a considerable height. When this is the case there is a risk of wounding the middle and inferior hæmorrhoidal vessels, and even the superior; the operation is not free from danger in this respect, and for that reason it is preferable to make use of the ecraseur of M. Chassaignac. Other fistulæ sometimes form around the anus, but they differ considerably from the preceding, inasmuch as they are symptomatic either of caries of the sacrum or even of the coccyx, or of any other region of the vertebral column, or of a cancerous or tubercular affection of the inferior extremity of the rectum. These kinds of fistulæ are very difficult to cure For instance, it is evident that cancerous fistulæ may close up for a time, but that shortly they will reopen or establish themselves elsewhere in the neighbourhood. Tubercular fistulæ, which must be distinguished from fistulæ occurring in tuberculous subjects, pursue the same course. Should the fistulæ which form in tuberculous patients be operated on? In my opinion there is no reason they should not when they show themselves during the first period of pulmonary phthisis. At a later period I should not recommend the operation. Fistulæ, symptomatic of disease of the bones of the pelvis or of the vertebral column, always require a very lengthened period of treatment, and they cannot heal if the disease of the bone is not curable.

Tumours of various kinds occur at the margin of the anus and in the anal region. The most common are formed by hæmorrhoids, whose presence is easily explained by the abnormal development of the hæmorrhoidal vessels which surround the inferior extremity of the rectum. These arteries and veins form three series, belonging to the superior, middle and inferior hæmorrhoidal, which by their anastomoses with the preceding vessels establish a communication between the portal and general venous system. This communication with the portal system accounts for the occurrence of hæmorrhoids as a symptom of disease of the liver and is the reason why it is necessary for the surgeon to examine the latter organ as well as the whole of the abdomen before removing these vascular tumours. There is also an anatomical reason for the frequent occurrence of hæmorrhoids, and that is the absence of valves in all the veins of the anus and the rectum. But as the blood is compelled to move against the force of gravity at its commencement, and afterwards has to traverse the liver through the capillary system of the vena portæ, a stagnation is produced, causing the veins to enlarge and form the vesicular dilitations termed *hæmorrhoids* These considerations show that the excision of these tumours is attended with several dangers, first hæmorrhage and then phlebitis. The ecraseur has almost entirely removed these dangers. A great inconvenience sometimes attends the removal of hæmorrhoids, and that is the contraction of the anus. When these tumours occupy the whole circumference of the anus, if we remove all the hæmorrhoids at once, we necessarily remove the whole of the mucous membrane. This produces a cicatrix which contracts the anus and may ultimately close it up more or less completely. Under these circumstances only a portion of the hæmorrhoids should be removed.

Cancerous tumours which occupy the margin of the anus often commence in the rectum. Their removal is attended with all the dangers belonging to such tumours; but here the danger is increased by the difficulty of the operation and by the hæmorrhage which may accompany or follow it. The use of the ecraseur often does away with these dangers.

Foreign bodies, polypi, or cysts, and invaginations, which sometimes occur at the margin, will be considered when speaking of the rectum, the organ with which these tumours are more immediately connected.



LIBRAIRIE GERMER BAILLIÈRE

PLATE LXV.

Region of the Scrotum or Testes.

EXPLANATION.

RIGHT SIDE (*first layer*).

A. Section of the skin covering the root of the penis.
A′. Section of the skin covering the inguinal region.
A″. Section of the skin towards the commencement of the scrotum.
A‴. Section of the skin of the scrotum.
B. Superficial fascia on a level with the penis.
B′. Section of the superficial fascia on a level with the penis.
B″. Superficial fascia opposite the external inguinal ring.
B‴. Section of the superficial fascia opposite the base of the scrotum.
B⁗. Section of the superficial fascia towards the inferior extremity of the scrotum.
C. The dartos covering the penis.
C′. Section of the dartos covering the penis.
C″. Section of the dartos at the base of the scrotum.
C‴. Section of the dartos opposite the testicle.
C⁗. Section of the dartos opposite the septum of the scrotum.
C′′′′′. Layer of the dartos forming the septum of the scrotum.
D. Fibres of the dartos inserted into the skin of the scrotum.
E. Fibrous tunic of the scrotum.
E′. Section of the fibrous tunic of the scrotum opposite the root of the penis.
E″. Section of the fibrous tunic of the scrotum opposite the spermatic cord.
E‴. Section of the fibrous tunic of the scrotum opposite the testicle.
E⁗. Section of the fibrous tunic of the scrotum opposite the septum.
F. Internal surface of the fibrous tunic assisting in forming the septum.
G. Fibrous tunic of the scrotum prolonged over the penis.
H. Muscular tunic formed by the fibres of the cremaster (Tunica vaginalis).
H′. Tunica vaginalis terminating by an expansion of its fibres at the inferior part of the region.

1. External pudic artery.
2. Section of the external pudic artery going to the scrotum.
3. Artery of the cord.
4. Second branch of the external pudic anastomosing with the spermatic artery.
5. External pudic vein.
6. Section of the branch of the external pudic vein going to the scrotum.
7. Spermatic vein accompanying the artery of the same name.
8. Vein accompanying the inferior branch of the external pudic artery.
9. Veins of the septum of the scrotum.

LEFT SIDE (*second layer*).

A. Section of the skin near the groin.
A′. Section of the skin near the cord.
A″. Section of the skin near the testicle.
B. Section of the superficial fascia near the groin.
B′. Section of the superficial fascia opposite the cord.
B″. Section of the superficial fascia opposite the testicle.
C. Section of the dartos near the groin.
C′. Section of the dartos opposite the spermatic cord.
C″. Section of the dartos opposite the testicle.
D. Fibrous membrane opposite the groin.
D′. Section of the fibrous tunic opposite the cord.
D″. Section of the fibrous tunic opposite the testicle.
E. Section of the tunica vaginalis opposite the root of the cord.
E′. Section of the tunica vaginalis opposite the cord.
E″. Section of the tunica vaginalis opposite the testicle.
F. Root of the penis.
G. Deep fibrous tunic.
G′. Section of the fibrous tunic to show the structure of the cord.
H. Section of the tunica vaginalis towards its upper part.
H′. Section of the tunica vaginalis opposite the body of the testicle.
I. Testicle.
J. Epididymus (head of).
K. Superior *cul de sac* of the tunica vaginalis.
L. Spermatic cord.

1. External pudic artery.
2. Spermatic artery.
4. External pudic vein.
5. Section of the spermatic veins.
6. Another spermatic vein.
7, 8. Spermatic nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The region of the scrotum like the mammary region abounds in applications to pathology and operative surgery In both these regions we meet with numerous and complicated structures; and we might say that the scrota region affords almost a complete series of the diseases to which the body is liable. To show the truth of this remark, it is sufficient to enumerate the various layers of which it is composed.

The skin of the scrotum is very lax, plicated and thin, qualities which bestow upon it great extensibility and enable it to cover tumours of a large size which either commence in the region or become lodged in it, having originated elsewhere as in cases of hernia Its thinness explains at the same time why the rays of light can pass through it and enable us to ascertain the transparency of certain cysts and of some hydroceles. Its folds and its great delicacy, which make it resemble a mucous membrane, explain the frequent occurrence of simple or specific inflammations, inasmuch as the remains of the epithelum, the secretrions, foreign substances and powders can easily accumulate between the folds. For the same reason the syphilitic virus remaining on the skin innoculates it in the same manner as the mucous membrane of the glans and produces a chancre of the scrotum. This skin also possesses a great number of sebaceous glands which may become inflamed or converted into cysts; recently a hospital surgeon, M. Bauchet, published a case of this kind of cysts of the scrotum. The constant irritation the skin is subjected to from friction, from the deposit of foreign substances, or the accumulation of dirt, explains why it is occasionally attacked with a kind of cancerous affection formerly known as *chimney sweepers' cancer*.

The subcutaneous cellular tissue is very yielding, composed of large meshes, and containing only a small quantity of fat; hence the facility with which it becomes infiltrated with serum or urine, and is attacked with inflammation. This cellular tissue easily mortifies, and this mortification often involves that of the skin of the scrotum, so that the testicle is sometimes left exposed. A remarkable circumstance is that the neighbouring skin is gradually altered, and ultimately recovers the testicle, a circumstance which is explained by the laxity of the skin at this part.

These fibrous and muscular layers do not present many special diseases for our notice; but it is not so with regard to the deeper seated tissues and organs; the tunica vaginalis, the testis, and the spermatic cord offer a large series of pathological changes. We meet with all the diseases of serous membranes, and of glands and their excretory ducts. Without passing in review all these disorders, we will fix our attention for a moment upon those amongst them which are more particularly dependent upon the anatomy of the parts.

Let us speak first of effusion of blood into the scrotum, also known as *hæmatocele of the scrotum.* These discharges had been imperfectly described by the best writers of our time when turning my attention to the cases observed in hospital practice and more especially to those under the care of M. Velpeau during the time I was acting as house-surgeon, I published in 1851 (*Archives générales de médecine* for March) a memoir in which I showed that the seat of these effusions was very variable and established the following varieties: 1. vaginal hæmatocele; 2. parietal hæmatocele; 3. parenchymatous hæmatocele; 4. vaginal hæmatocele; 5. hæmatocele of the cord. Some of the varieties presented themselves under two forms, that by infiltration, and that by effusion, or encysted. With regard to hæmatocele of the tunica vaginalis, Professor Gosselin in his investigation of the diseases of the scrotum has shown that it sometimes occurs in concentric layers, and that it is hard and must be cured by removing the different layers (*decortication*). This kind of hæmatocele described by M. Gosselin is sometimes primary, sometimes consecutive.

Hydrocele like hæmatocele presents several well-known varieties distinguished according to their anatomical situations. I shall refer more particularly to a new variety which I described in June, 1856 *(Archives générales de médecine*). In a paper entitled *Remarques sur l'anatomie pathologique d'une forme nouvelle de l'hydrocèle*, I have described hydrocele of the tunica vaginalis in the form of a double sac in which the two sacs communicated by a narrow opening This circumstance led me to a more careful study of the tunica vaginalis, and I discovered that it presented several diverticula whose excessive development produces this form of hydrocele: these diverticula are three in number: 1. the funicular; 2. the epididymal; 3. the testicular.

The tunica vaginalis may become inflamed from various causes, and this inflammation produces all the results that occur in the case of other serous membranes, such as plastic exudations, false membranes, adhesions, &c. The surgeon sometimes endeavours to obtain the latter result for the purpose of effecting a cure in certain cases, as, for instance, in hydrocele, and it is in this way that the injection of iodine, first proposed by M. Velpeau, is so useful.

The organisation of the plastic exudations in the tunica vaginalis sometimes gives rise to the formation of *foreign bodies;* the same thing may also be the result of epithilial accumulations. These small bodies are generally of a rounded form, hard, of a whitish colour, and cartilaginous; they will sometimes remain for a long time without producing any ill effects; but in general the irritation they produce gives rise to a hydrocele, or even to a hæmatocele.

When the inflammation extends to the testicle and its appendages it has received the name of *orchitis.* The progress of anatomy has, however, enabled us to distinguish between vaginitis, epididymitis and *orchitis*, properly so called, or inflammation of the testicle; these different kinds of inflammation are especially prone to occur during an attack of gonorrhœa or any irritation of the urethra or spermatic duct. I have shown that orchitis might be the consequence of a general disease, such as small pox. In a memoir published in the *Archives générales de médecine* (March, 1859), I have described all the forms of this *variolus orchitis.*

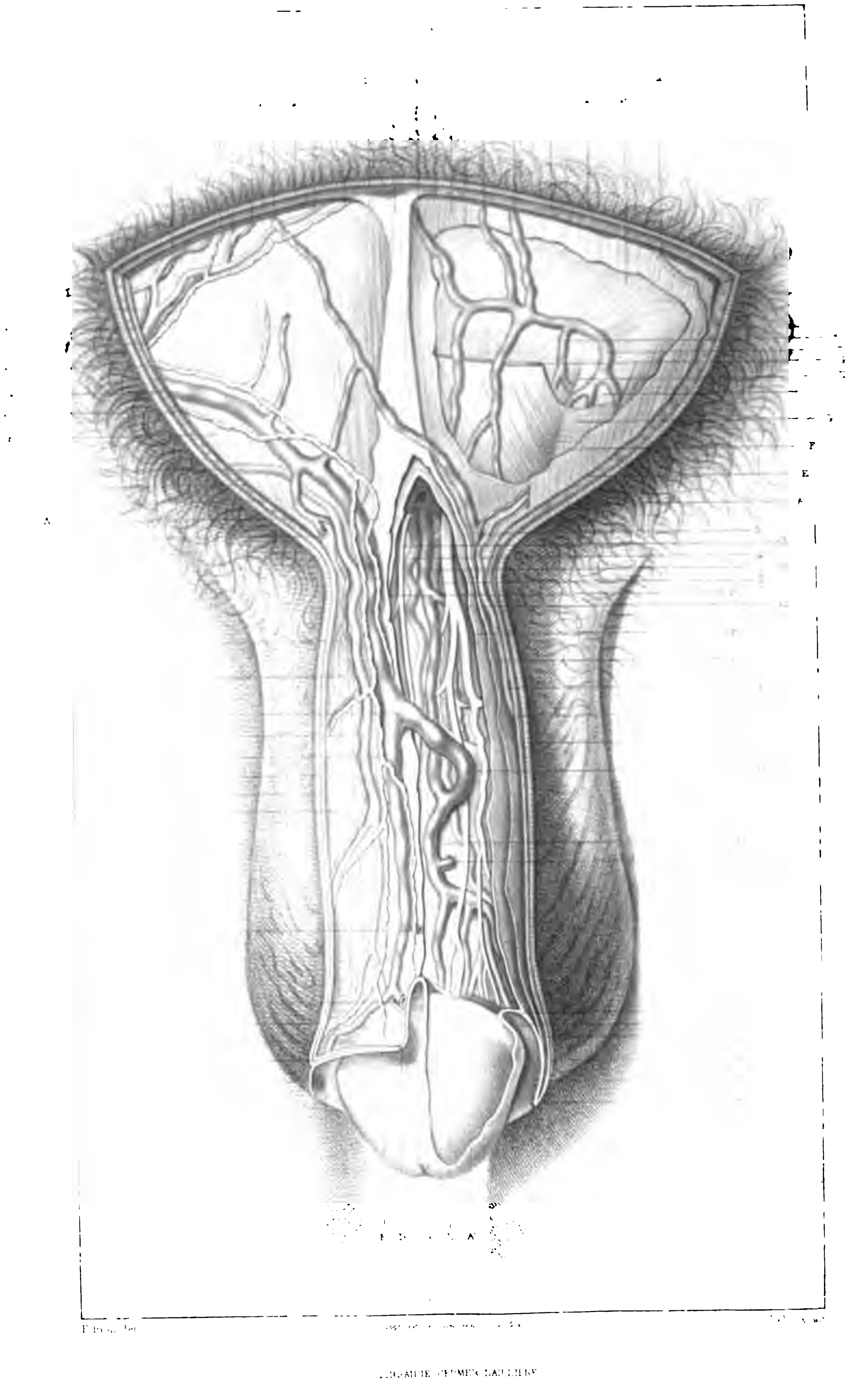
Under the name of *syphilitic orchitis* an affection has been described whose inflammatory character is not distinctly proved, but which is nevertheless the result of the syphilitic infection and shows itself principally during the *tertiary stage.* This disease may be easily cured without any operation by means of the iodide of potassium alone, whether it is complicated with hydrocele or not. I have recently succeeded in curing a case of this kind of orchitis where it was complicated with a hydrocele.

Cysts, cancer, tubercle, hypertrophy, and congestion frequently occur in this organ.

Contained in a fibrous covering, the parenchymatous structure of the kidney is slightly compressed, so that if the fibrous tunic becomes elongated or destroyed at any point, the substance of the testicle has a tendency to escape at that part where it emerges in the form of a reddish, fungus-like mass. Amongst these tumours of the testicle we may mention more particularly that form known as enchondroma, which was the subject of a very interesting memoir presented by M. Danové, and upon which I made a report to the *Société de chirurgie* towards the close of the year 1861.

Many operations are performed on the scrotum; but we shall only speak of the two most important, castration, and that for varicocele. Castration consists in the removal of the testicle; this organ receives at its upper part numerous vessels of considerable size which may give rise to hæmorrhage. To avoid this, it has been recommended to tie the vessels altogether (*en masse;*) but this method has the serious inconvenience of tying at the same time the fibrous tissues, the nerves, and even the spermatic cord, thereby producing both pain and strangulation. We prefer the method of Blandin, which consists in dividing the different elements of the cord by a number of small incisions and tying the vessels as they are divided. By this means we avoid all the inconveniences just mentioned, and the cord is held apart during the operation.

The large number of veins and the long course they pursue, the compression they are subjected to at various parts are so many causes of that varicose condition in the scrotum, also termed *varicocele.* In the present day we only operate in extreme cases, and then the dilated vessels must be very carefully isolated, so as not to include the arteries and the spermatic duct. The density of the duct enables us to detect it beneath the skin and to put it aside.



LIBRAIRIE GERMER BAILLIÈRE

PLATE LXVI.

Region of the Pubis and of the Penis.

EXPLANATION.

RIGHT SIDE *(first layer)*.

A. Section of the skin bounding the region above and laterally.
A′. Section of the skin on the penis.
A″. Section of the skin near the prepuce.
B. Free margin of the prepuce.
C. Superficial fascia opposite the pubic region.
C′. Section of the superficial fascia on the penis.
C″. Section of the superficial fascia opposite the prepuce.
D. Deep fascia
D′. Section of the deep fascia opposite the pubis.
E. The dartos in the inguinal and pubic regions.
E′. The dartos continued on to the penis.
E″. Circular fibres of the dartos opposite the prepuce.
F. Mucous membrane of the glans penis.
G. The meatus urinarius.

1, 2. Pubic branches of the external pudic artery.
3. Branch of the external pudic artery furnishing some branches to the root of the penis.
4. External pudic vein slightly varicose.
4′. Anastomosis of the external pudic vein with the dorsal vein of the penis.
5. Section of one of the branches of the external pudic coming from the root of the penis.
6, 7. Section of venous branches coming from the prepuce and anastomosing with those from the opposite side in the median line.
8, 9 Veins accompanying the pubic artery.
10. Anastomoses of the external pudic veins with the veins of the abdominal integument of the opposite side.
11. Lymphatic vessels of the abdominal parieties.
12, 12′. Lymphatic vessels of the penis.
13, 14. Superficial nerves of the penis.

LEFT SIDE *(second layer)*.

A. Section of the skin near the pubis.
A′. Section of the skin of the pubis.
A″. Section of the skin of the prepuce.
A‴. Surface of the prepuce.
A⁗. Section of the mucous membrane of the glans.
B. The corona glandis.
C. Superficial fascia.
D. Section of the superficial fascia opposite the pubis.
D′. Section of the superficial fascia opposite to the penis and lower down to the prepuce.
E. Section of the superficial fascia near the root of the cord.
E′. Section of the superficial fascia on the body of the penis.
E″. Section of the superficial fascia on the prepuce.
F. The dartos near the pubic region.
F′. Section of the dartos opposite the pubic region.
F″. Section of the dartos opposite the penis.
F‴. Section of the dartos in the median line opposite the prepuce.
G. Fibrous tunic of the cord.
G′. Section of the fibrous tunic of the cord.
H. Aponeurosis of the obliquus externus abdominis.
I. Fibrous membrane of the penis.
J. Spermatic cord surrounded by its deep fibrous tunic.
K. Internal margin of the cord beneath which a vein passes.
L. The glans penis deprived of its mucous membrane to show its fibrous membrane.

1. External pudic artery.
2. Pubic branch of the external pudic artery.
3. External branch of the dorsal artery of the penis extending to the prepuce.
4. Internal branch of the dorsal artery of the penis.
5. Veins of the integument from the right side of the abdomen anastomosing with the left external pudic vein.
6. Branches of the vein of the integument.
7, 8. Veins forming an anastomosis between the tegumentary, the spermatic, and the external pudic veins.
9. Dorsal vein of the penis.
10. Branch of the dorsal vein of the penis coming from the corpus cavernosum.
11. Anastomosis of the dorsal vein with the right external pudic vein.
12. Dorsal nerve of the penis (external branch).
13. Dorsal nerve of the penis (internal branch).

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The pubic portion of this region is comparatively unimportant. The skin is remarkable for its thickness, the number of its follicles, and for its hair; the latter imparts a special character to its inflammation the same as it does to that of the scalp; and therefore the views which apply to the latter are also applicable to the mons veneris. The subcutaneous cellular tissue is very plentiful, and its meshes enclose a considerable quantity of globular fat, so that it is not uncommon to meet with lipoma in this region. The vessels are not of such a size as to produce any fear of hæmorrhage in the operations performed on the region. The only really important part of the region is the symphysis pubis. We know that in the female in consequence of pregnancy the articulation undergoes important changes; the ligaments, for instance, become soft and yielding, a circumstance which should be borne in mind in cases of contracted pelvis. A similar condition will render the operation of symphyseotomy easy of performance. On the other hand, this condition may continue and produce what is commonly known as relaxation of the symphysis pubis. This lesion is an impediment to walking, to maintaining the erect position, and even to the movements of the lower extremities, which no longer find a sufficiently firm point of resistance in the bony arch of the pelvis. To remedy this state of things the patient should maintain the recumbent position and wear a girdle which should press upon the lateral parts of the pelvis and so bring them together at the symphysis. The symphysis sometimes becomes inflamed after delivery, especially when the labour has been tedious and required the use of instruments. When this happens, there is an acute pain in the central portion of the region, or upon introducing a finger into the vulva and pressing on the symphysis from below upwards. This inflammation is rarely followed by suppuration. Nevertheless M. Monod has mentioned an instance where suppuration occurred, and we have ourselves in a recent case seen it take place in a woman who had undergone several applications of the forceps and of the cephalotribe.

The skin of the penis is rather thin, very extensible, and contains a large number of sebaceous glands whose secretions sometimes accumulate and form small tumours. It is not uncommon for these glands to become inflamed and give rise to a small abscess, which after it has opened, is followed by ulceration, so as to be mistaken for an indurated chancre. There are also specific ulcerations of these glands, to which the name of *follicular chancre* has been given. At the anterior part where the skin is folded back, it gradually assumes the characters of a mucous membrane and forms around the glans a covering called the prepuce. This mucous membrane has a slightly pinkish tint on its inner surface, but is dull and whitish in young children; it is often the seat of an abundant secretion, especially in the circular groove which separates the glans from the body of the penis. This secretion is sufficiently acrid to inflame the surfaces and produce a discharge called a *false gonorrhœa*. Beneath the glans is a fold of skin called the *frenum of the penis*, which extends towards the meatus and is of a variable length. If it is too short, or extends too far forwards, it draws down the glans towards its inferior surface and impedes copulation or makes it painful, rendering it necessary to divide the frænum. This operation is very simple, but it must be borne in mind that hæmorrhage may follow. This is explained by the presence of an artery and of a venous network of a tolerable size in its tissue. If this accident should occur it may be controlled by the application of the perchloride of iron on lint. As the frænum is stretched in the act of copulation, it may be torn, which explains why chancres occur more frequent upon it or in its neighbourhood than elsewhere.

Regarded as a whole, the prepuce is a canal or sheath open in front and terminating behind in a *cul de sac*, placed around the base of the glans. The anterior extremity is sometimes so narrow that it will scarcely admit of micturition. When this is the case, the urine collects in the cavity of the prepuce and distends it to a greater or less extent; micturition takes place into a kind of supplementary bladder, which not being contractile the urine passes slowly away drop by drop. This bladder is never completely emptied, and the consequence is that inflammation is set up, or even calculi formed either as deposits from the urine, or as accumulations of sebaceous matter. These inconveniences are to be remedied by performing the operation of phimosis, an operation which consists in enlarging the opening of the prepuce, either by means of a circular insision removing a part of the foreskin, constituting circumcision, or by a simple division along the dorsal surface of the prepuce.

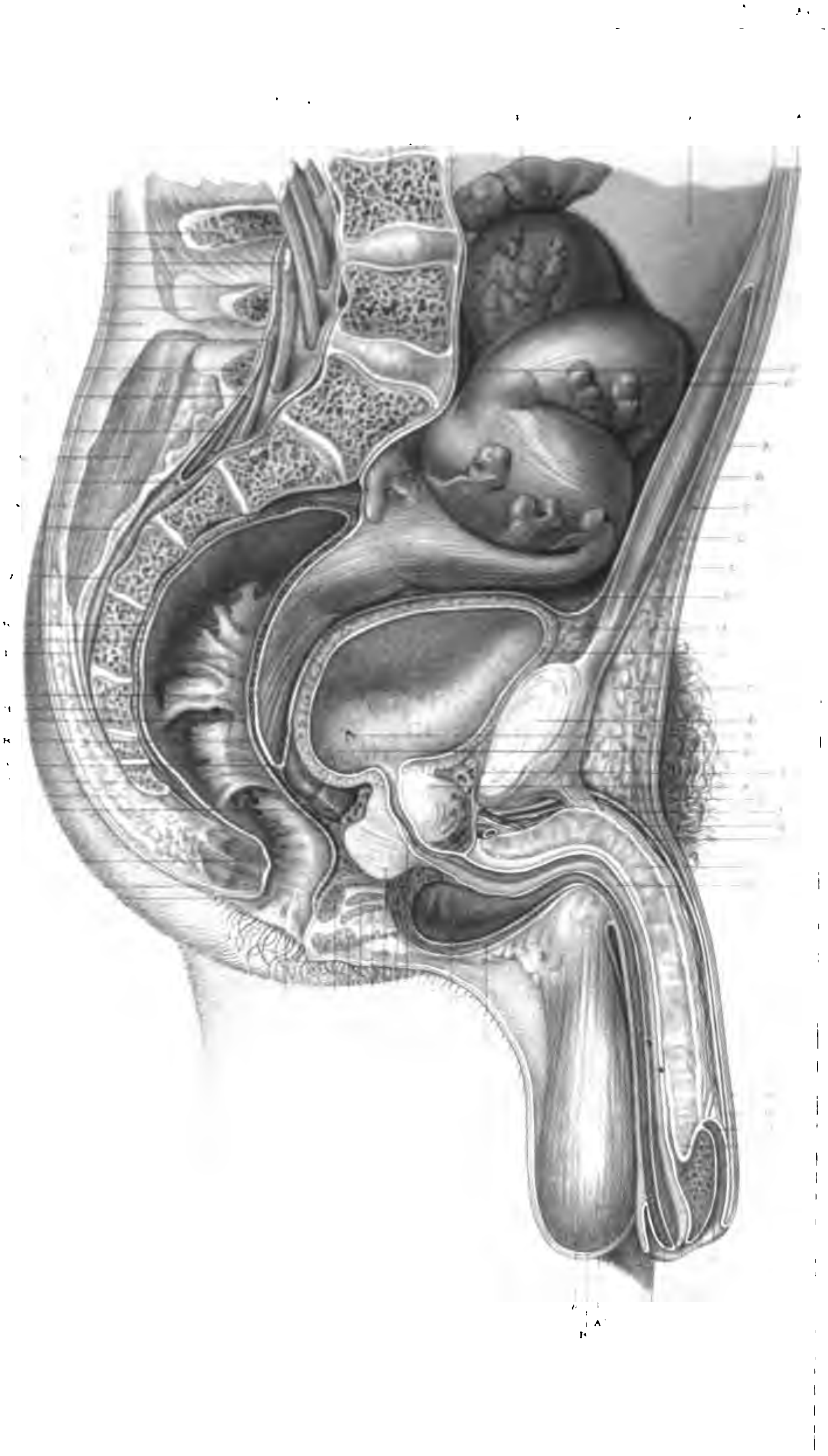
In other cases the opening is not so narrow, but still admits the passage of the glans with difficulty; the consequence is that when it is exposed it is somewhat constricted at its base, swells, and cannot be returned through the opening of the prepuce. This constitutes *paraphimosis*. The constriction may exist in various degrees, in the extreme state, the constricting ring is so tight, that the glans or a part of it will speedily mortify unless relief is given. The glans must be reduced in the same way as we reduce a hernia, and if this cannot be accomplished it must be liberated by dividing the ring of the prepuce which is the cause of the strangulation.

The penis is often the seat of cancer, which most frequently commences at the anterior part in the prepuce or in the glans. This disease presents a special character in this region, and of which the surgeon may advantageously avail himself in his operation. Thus, so long as the cancer has only attacked the prepuce, it may easily be removed without sacrificing any portion of the penis. When the cancer has attacked the penis, it sometimes seems impossible to reach its ultimate ramifications, but this is not really the case. The following is what takes place. In proportion as the cancer extends it presses back the tissues rather than invades them, and then for a considerable time it remains merely cutaneous. The spongy tissue of the penis becomes obliterated in front of the tumour and seems to retreat in consequence of its erectile character. Besides this, the spongy tissue is protected by a thick, slightly vascular, fibrous membrane, which for a long time forms an impassable barrier to the cancer. Thus, on taking into consideration these peculiarities, we may remove a cancer of the penis which at the first sight would seem to be past operating on. If the spongy tissue of the penis long escapes the cancerous degeneration, on the other hand, when once it is attacked it spreads very rapidly, and the disease quickly passes from one part to another. Thus, a cancer which has remained for several years without reaching the spongy tissue of the urethra, the glans, or the penis, may spread through this same tissue in the course of a few days. I believe I have discovered a valuable method of diagnosing these different conditions before proceeding to operate. It is sufficient to introduce a sound into the urethra, and if we perceived hard lumps and inequalities in the canal opposite the disease, we may rest assured that the spongy tissue is affected and that amputation must be resorted to; on the contrary, if the sound passes easily through the canal, it is very probable that the spongy tissue is not altered, that is, the cancer is confined to the skin, and excising the part will be sufficient. It is unnecessary to dwell upon this new means of diagnosis.

The vascular spongy tissue of the penis being contained in a fibrous sheath, any swelling of the part is limited by this fibrous case, and cicatrices in the fibrous canal generally change more or less the form and direction of the organ; during erection, or in chordee, if we try suddenly to bend the penis, the fibrous structure more readily tears than bends, and these ruptures may be followed by hæmorrhage from the urethra. It is in this way that we explain the relief obtained by some patients, but a fungoid, aneurysmal, or varicose tumour very difficult to cure may be the result. In some extremely rare cases, the septum of the corpora cavernosa has been known to become cartilaginous, or even osseous; such a condition, it is easily understood, would render amputation of the penis somewhat difficult. M. Velpeau has met with about ten of these cases in his practice.

The spongy tissue of the penis may also be the seat of other physical and organic lesions. It is occasionally liable to be cut or bruised. Hæmorrhage frequently occurs, and it may be either arterial, venous, or capillary; when it proceeds from the corpora spongiosa it is very difficult to arrest, as is the case after amputation of the organ. The application of ice, the actual cautery, or the perchloride of iron is of great service in these cases. Amongst the organic lesions may be mentioned nodes of the penis. These may be cured by the use of the iodide of potassium, but they are sometimes followed by the obliteration of a portion of the spongy tissue, rendering erection impossible at that part, and producing consecutively a change in the form and direction of the penis which is incurable.

The two *dorsal* arteries are contained in a yielding and moveable sheath, and retract considerably after amputation. On the contrary, the two *cavernous* arteries which are situated in the spongy tissue, do not retract at all, the erectile tissue in which they are placed preventing it. Thus, after amputation there are four arteries to be tied. The veins alone form almost the whole of the spongy tissue of the urethra, and constitute large subcutaneous trunks, as may be seen in the present Plate. These are sometimes the seat of phlebitis or of a varicose condition. The lymphatics, which are large and frequently the seat of specific inflammation, pass to the groin, where they give rise to *bubos*, following chancre.



LIBRAIRIE GERMER BAILLIÈRE

PLATE LXVII.

Region of the Pubis.

Antero-posterior section of the penis and of the pelvis, including the urethra.

EXPLANATION.

A.	Section of the skin of the anterior wall of the abdomen.
A′.	Section of the skin on the dorsum of the penis.
A″.	Section of the skin of the lumbo-sacral region.
B.	Section of the superficial fascia of the anterior wall of the abdomen.
B′.	Section of the superficial fascia on the dorsal surface of the penis.
B″.	Section of the subcutaneous cellular tissue in the dorsal region.
B‴.	Section of the superficial fascia and of the subcutaneous cellular tissue of the lumbo-sacral region.
C.	Subcutaneous adipose tissue of the pubis.
C′.	Subcutaneous adipose tissue of the thigh.
D.	Body of one of the lumbar vertebræ.
D′.	Spinous process.
E.	Spinous process.
F.	Section of the crest of the sacrum at its upper part.
G.	Section of the crest of the sacrum at its middle part.
H.	Section of the body of the sacrum.
I.	Sacro-coccygeal ligament closing up the sacral canal below.
J.	Intervertebral disk.
K′.	Section of the accelerator urinæ muscle.
L.	Rectus abdominis muscle in its aponeurotic sheath.
L′.	Anterior layer of the aponeurotic sheath of the rectus abdominis muscle.
M.	Interspinal muscle.
M′.	Glutæus maximus muscle.
N.	Aponeurosis of the glutæus maximus muscle.
N′.	Section of the aponeurosis of the glutæus maximus muscle.
O.	Peritoneum lining the posterior surface of the anterior wall of the abdomen.
O′.	Peritoneum lining the anterior surface of the posterior wall of the abdomen.
O″.	Vesico-rectal peritoneal *cul de sac*.
O‴.	Peritoneum reflected from the abdominal parietes on to the bladder.
P.	Section and ligature of the descending colon.
Q.	Interior of the rectum with its valves or folds.
R.	Section of the muscular fibres of the posterior and anterior walls of the rectum.
S.	Section of the mucous membrane of the rectum.
T.	Suspensory muscle of the rectum and elevator of the anus
U.	Opening of the anus.
V.	Section of the posterior part of the external sphincter of the anus.
V′.	Section of the anterior part of the external sphincter of the anus.
V″.	Section of the internal sphincter of the anus.
X.	Section of the superior fibres of the transverse muscle of the perineum.
X′.	Section of the inferior fibres of the transverse muscle of the perineum.
a.	Cavity of the bladder and opening of the urethra.
a′.	Base of the bladder.
b.	Section of the muscular fibres of the bladder.
c.	Section of the mucous membrane of the bladder.
d.	The urethra.
e.	Meatus urinarius and the navicular fossa behind.
f.	Cellular tissue separating the bladder from the rectum.
g.	Prostate gland.
h.	The veru montanum or crest of the urethra.
i.	Section of the spongy tissue of the urethra.
j.	Suspensory ligament of the penis.
k.	Section of the symphysis pubis.
l.	Bulb of the urethra.
m.	Corpus spongiosum of the urethra.
m′.	Section of the corpus spongiosum.
n.	Fibrous covering of the glans
o.	*Cul de sac* of the prepuce and the glans.
p.	Fibres of the dartos in the scrotum.
q.	Sacral canal and the dura mater.
r.	Section of the dura mater in the sacral canal.
s.	Section of the dura mater in the lumbar region.
1.	Dorsal artery of the penis.
2.	Dorsal vein of the penis.
2′.	Venous plexus.
3.	Dorsal nerve of the penis.
4, 5, 6, 7.	Lumbar nerves.
8, 9, 10.	Sacral nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

We propose to give a minute account of the form, direction and dimension of the urethra, so that the present Plate may be consulted with as much advantage as the subject itself, only it must be remembered that the proportions of the parts are reduced to one half of the natural size.

With regard to the length of the canal, the results are very different according as the measurements are taken from the urethra when detached from the surrounding parts and extended on a table or from a urethra in its natural position. This accounts for the wide differences which exist in the statements of different writers. What the surgeon especially requires to know is the natural conditions of the urethra in a person about to undergo an operation. Under these circumstances the length of the canal is from thirteen to sixteen centimetres (5·11 to 6·29 English inch). The length of the prostatic portion is about two centimetres (·78 English inch), but in old persons, in consequence of hypertrophy of the prostate, it may attain the length of four or even five centimetres (1·57 to 1·96 English inch), as I have shown by my researches, the results of which are contained in my thesis entitled ***Maladie de la prostate*** (Paris, 1857). This increased length should be known to the surgeon in passing the catheter, in order that he may not raise the point of the instrument too soon and thus avoid tearing the prostate.

The membranous portion is divided obliquely from above downwards and from before backwards, the upper boundary measuring from eighteen to twenty millimetres (·708 to ·787 English inch) while the lower is only from twelve to fifteen millimetres (·472 to ·590 English inch).

The spongy portion of the urethra is the largest, measuring from ten to twelve centimetres (3·93 to 4·72 English inch); but whilst the other two portions are fixed and are but slightly extensible, this may vary greatly in a short time, either from the erection or extension of the penis, and for this reason the penis should not be dragged when we wish to measure its length.

The direction of the urethra has also been the subject of many contradictory statements. Instruments either curved or straight can easily be introduced into the urethra, but that does not prove that the canal is either curved or straight, it simply shows that it can accommodate itself to the catheters and take their form. It is sufficient to look at Plate LXVII to see that in the normal state, and apart from any modification produced by an instrument, the urethra presents two distinct portions; the first, extending from the meatus to the suspensory ligament of the urethra, is straight; the second, reaching from the ligament to the bladder, is curved with the concavity directed upwards and the convexity downwards; but this concavity may be entirely obliterated by a straight instrument, so that if we straighten the portion in the penis, the urethra will be nearly straight throughout its entire length, and Amusat has rendered an essential service to lithotrity by demonstrating this fact which had been previously disputed. But let it also be borne in mind that J. L. Petit was right in desiring that instruments intended to remain in the urethra should be curved, because by that means we avoid compressing and injuring the parts which have been straightened.

The urethra is not of the same diameter in all the regions, neither is it equally dilateable. By injecting it with wax we obtain a cast of the canal and perceive that there are three dilitations alternating with three contractions. Almost immediately behind the meatus there is a fusiform dilitation from six to eight millimetres (·236 to ·314 English inch) in length corresponding to the navicular fossa; behind this dilitation is a contracted portion which extends to below the symphysis; beyond this point we meet with a second and more considerable dilitation than the first, which terminates suddenly at the junction of the bulb with the membranous portion, and corresponds to the *cul de sac* of the bulb; lastly, opposite the prostate gland there is a slight dilitation which terminates at the neck of the bladder.

The meatus urinarius is the least extensible of the narrow portion; it follows from this that if the meatus is naturally narrow we can only introduce into the canal small bougies which will not enable us to detect certain strictures, so that they will remain latent. Many urethral discharges are due to contractions of this kind, and unless we enlarge the meatus we cannot cure them. I have already done this three times in similar cases and succeeded where others had failed, in consequence of their not having dilated the meatus beyond its natural size. Opposite the navicular fossa the canal is very dilateable, so that it is not uncommon to find calculi arrested at this part. The dilateability of the canal is very great at the spongy portion, and is still greater at the sinus of the urethra, and it is to be observed that this is one source of difficulty in catheterism because the point of the sound or bougie impinges against the parietes of this dilated portion of the canal. At the neck of the bulb and in the membranous portion the dilateability of the canal is still considerable, although less than in the last portions. In the prostate portion the canal is naturally large, but enlarges still more under the influence of instruments or of calculi, especially in infants, so that even large stones may be extracted from the bladder without dividing its neck and the prostate.

The size of the urethra at its narrowest part is four millimetres (·157 English inch); does it follow that the surgeon should therefore stop at that size in enlarging a stricture? We think not. But then what is the extent to which he ought to carry the dilitation? We think that the urethra will bear being dilated to the extent of eight or nine millimetres (·314 to ·354 English inch).

The mucous membrane of the urethra is smooth, delicate, of a pinkish colour near the meatus, greyish in the spongy portion, of a somewhat brownish tint near the bulb, and again greyish opposite the prostate: its internal surface presents projections, valves, lacunæ and openings. The projections are: 1. papillæ which occur opposite the glans and explain the acute sensibility of this part when, for instance, a sound is introduced; 2. the crest of the urethra. There are several kinds of valves. Near the internal orifice, behind, we see the valve which occupies the lower half of the circumference of that opening and against which the point of the sound comes in contact if we are not careful to make it traverse the upper part of the canal. M. Guérin has mentioned the existence of a valve in the upper wall of the navicular fossa which from its being directed forwards is an impediment in catheterism if the point of the sound is not directed downwards.

These lacunæ are distributed throughout the whole extent of the canal and over all parts of its parieties; they are directed forwards, and may thus become an impediment in catheterism if the point of the sound enters them. May we not attribute the continuation of certain urethral discharges to their inflammation?

Numerous openings discharge on to the mucous membrane of the urethra the secretions of the glands that are annexed to this canal. Proceeding from before backwards we find the openings of the prostate, that of the utriculus or *sinus pocularis*, those of the ejaculatory canals, and lastly, more anteriorly the openings of Méry's or Cowper's glands. When the urethra is the seat of blennorrhagia, we often find the inflammation passes from before backwards and confines itself to one of the preceding openings or extends to the glands with which they are connected; it is in this way we may explain the occurrence of inflammation of the testicle, of the prostate, and of the glands of Méry during the progress of blennorrhagia.

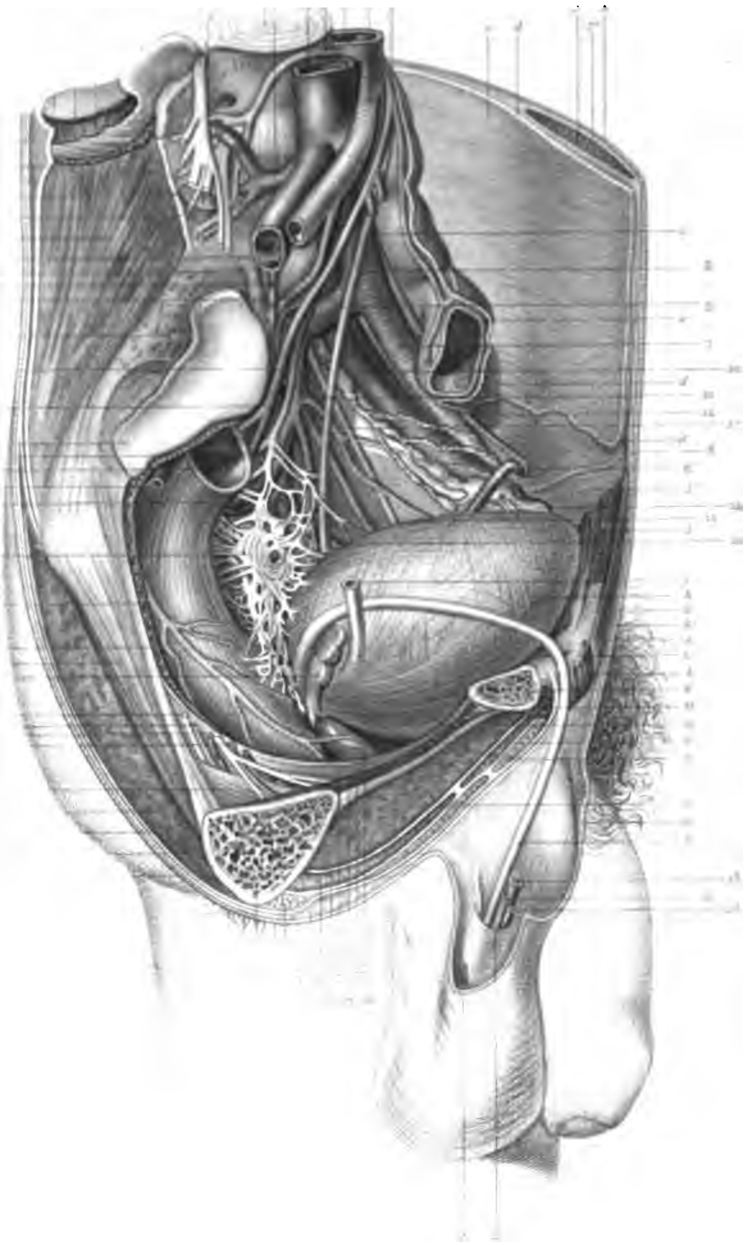
The submucous layer is formed of delicate cellular tissue, containing no fat and presenting some muscular fibres especially opposite the membranous portion. The nature of this tissue accounts for the occurrence of spasmodic strictures as well as the formation of organic strictures. In fact, the latter are not produced by the contraction of the mucous membrane itself, but by that which occurs in the surrounding cellular tissue as the result of plastic inflammation followed by contraction.

The vascular tissue which surrounds the mucous membrane of the urethra accounts for the hæmorrhages which result from lacerations or that are produced by instruments, calculi, or external violence, and the incisions made in the operation termed internal urethrotomy. As these discharges of blood come from a deep part, which is out of sight, and issue from a highly vascular spongy tissue it follows that they continue and may cause death. I lately saw a case of hæmorrhage from the urethra, where I first ordered the application of ice to the penis and ergotin internally; the hæmorrhage stopped for a short time and then returned with increased force. I next introduced a sound which at first had the same good effect, but subsequently the hæmorrhage again returned. Lastly, I made use of compression on the penis by means of strips of diachylon plaster, and was so fortunate as to succeed.

In Plate LXVII may be seen the form, size, and situation of the prostate in the adult, together with its relations with the urethra, the bladder, and especially the rectum, perineum, and cellular tissue of the pelvis. When the incision is made in the perineum for lithotomy and passes beyond its boundary, it reaches the pre-rectal and pre-vesical cellular tissue, and there is danger of an infiltration of urine which adds greatly to the perils of the operation. It is unnecessary on the present occasion to refer to all the well-known consequences arising out of the relations of the prostate with the surrounding organs in respect to the discharge of pus from abscesses situated in that organ.

Inflammation of the prostate may present several varieties as to its progress and situation. In respect to the first it may be acute, subacute, or chronic. As regards its situation it may be superficial or mucous, perenchymatous, or peripheral, or cellular. We shall not describe the varieties of these inflammations, but refer for the details to our thesis entitled *Maladies de la prostate* (Paris, 1857).

The changes which the prostate may undergo are of various kinds, we shall not, however, refer to cancer, hydatids or calculi which are very rare, but speak of the change which so often occurs in old persons, namely hypertrophy. Up to our time only one form of hypertrophy had been recognised, and that was of a fibrous character. But relying on the nature of the tissues which enter into the structure of this gland, and having proved that it contains not only glandular but also muscular tissue, we have shown that two forms of hypertrophy must be admitted, namely, fibrous and muscular hypertrophy.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXVIII.

Pelvic Region of the Man.

EXPLANATION.

A. Section of the skin of the anterior wall of the abdomen.
A′. Section of the skin opposite the pubis.
A″. Section of the skin opposite the penis.
A‴. Section of the skin opposite the region of the scrotum.
A⁗. Section of the skin opposite the region of the anus.
A′′′′′. Section of the skin opposite the anal region.
B.′ Fibrous covering of the spermatic cord.
B″. Section of the fatty subcutaneous cellular tissue of the perineal region.
B‴. Section of the subcutaneous cellular tissue of the sacral region.
B⁗. Section of the subcutaneous cellular tissue of the lumbar region.
C. Horizontal section of the inter-vertebral disk above the fourth lumbar vertebra.
C′. Spinous process of the fourth lumbar vertebra.
C″. Articular process of the fourth lumbar vertebra.
C‴. Transverse process of the fourth lumbar vertebra.
D. Transverse process of the fifth lumbar vertebra.
E. Articular surface of the sacrum.
F. Section of the horizontal branch of the pubis.
G. Section of the tuberosity of the ischium.
H. Greater sacro-sciatic ligament.
H′. Lesser sacro-sciatic ligament.
I. Section of the posterior sacro-iliac ligament.
I′. Aponeurotic insertion of the quadratus lumborum muscle.
J. Left rectus abdominis muscle.
J′. Section of the rectus abdominis muscle.
J″. Section of the aponeurosis of the rectus abdominis muscle.
J‴. Fascia transversalis.
K. Section of the pyramidalis muscle.
K′. Section of the aponeurosis of the pyramidalis muscle and left vas deferens.
L. Section of the tendon of the rectus abdominis muscle on the right side.
M. Pectineus muscle.
N. Small adductor muscle of the thigh.
O. Gracilis muscle.
P. Adductor longus femoris.
Q. Adductor magnus femoris.
R. External obturator muscle.
S. Internal obturator muscle.
T. Obturator fascia.
U. Tendinous portion of the muscles which are inserted into the tuberosity of the ischium.
V. Section of the glutæus maximus muscle.
V′. Section of the aponeurosis of the glutæus maximus muscle.
X. Sacro-lumbalis and longissimus dorsi muscles.
X′. Section of the common mass of these muscles.
X″. Section of the aponeurosis of the same.
Z. Section of the multifidus spinæ muscle.
Z′. Section of the aponeurosis which separates the multifidus spinæ from the common muscular mass.

a. Section of the pyramidalis muscle.
b. Section of the levator ani muscle.
b′. Section of the aponeurosis of the levator ani muscle.
c. Internal surface of the peritoneum.
d. Section of the peritoneum.
e. Section of the sigmoid flexure of the colon.
f. Section of the rectum.
g. Anus.
h. Muscular fibres of the bladder.
i. Left ureter.
j. Right ureter.
k. Vas deferens.
l. Vesicula seminalis.
m. Prostate.

1. Section of the trunk of the left common iliac artery.
2. Section of the inferior mesenteric artery.
2′. Inferior branches of the inferior mesenteric artery.
3. Ilio-lumbar artery.
4. Trunk of the right common iliac artery.
5. Middle sacral artery.
6. Trunk of the left common iliac.
7. External iliac artery.
8. Section of the epigastric artery.
9. Internal iliac artery.
10. Internal iliac giving off the vesical arteries.
11. Obturator artery.
12. Middle hæmorrhoidal.
13. Section of the branches of the internal pudic artery.
14. Left spermatic artery.
15. Section of the right spermatic artery.
16. Section of the inferior vena cava.
17. Section of the common iliac vein in which is seen the valves.
18. Middle sacral veins.
19. Ilio-lumbar veins.
20. Left external iliac vein.
21. Obturator vein emptying itself into the trunk of the internal iliac vein.
22. Section of the superior hæmorrhoidal vein.
23. Section of the spermatic veins of the right side.
24. Lymphatic glands and vessels accompanying the left iliac vein.
24′. Fourth branch of the lumbar plexus of nerves.
25. Lumbo-sacral nerve.
26. Branch of the internal pudic nerve.
27. Obturator nerve.
28. Afferent branch of the ilio-hypogastric nerve.
29. Ilio-hypogastric plexus of the sympathetic nerve with its afferent branches.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate, which, like the preceding, represents the organs contained in the pelvis of the male, gives rise to a similar series of applications to pathology and operative surgery. The observations we have made will therefore form in reality a continuation of those we have already given in Plate LXVII.

We have there spoken of the urethra and of the prostate, and it now remains for us to treat of the bladder, its appendages, and some of the neighbouring organs, such as the vasa deferentia, the vesiculæ seminales, the ureter, and the rectum; afterwards we shall make some remarks upon the walls of the pelvis.

With regard to the bladder, anatomy provides us with much valuable practical information. It is seen, for instance, that concealed as it is behind the symphysis pubis, this reservoir is apparently beyond the reach of external violence. This protection is, in fact, very efficient, yet in some cases the external force is so great as to reach the organ, as is seen in the case of injuries of the bladder from fire-arms. The surgeon has profited in certain cases by the relations of the anterior surface of the bladder with the symphysis pubis; thus, it has been proposed to penetrate the bladder through the symphysis itself; this proposal, however, has never been carried out; but M. Voillemier entertained the notion of availing himself of this relation, not by passing through the symphysis, which would be very difficult, but by passing beneath it and simply penetrating the subpubic ligament.

This operation offers the following advantages: absence of hæmorrhage, facility of execution, remoteness of the peritoneum, and therefore the certainty of its not being wounded. We believe that these advantages will cause it to be preferred to puncturing it through the hypogastrium, perineum, or rectum.

Wounds of the bladder of all kinds have been carefully studied by M. Houel in his inaugural thesis, which we strongly recommend to the attention of the student. The almost inevitable consequence of these wounds is the discharge of the urine. Two conditions may present themselves: if the wound occurs at a part of the bladder where it is covered by the peritoneum the urine escapes into the cavity of the peritoneum, and a peritonitis that speedily proves fatal is the consequence; on the other hand, if the wound is in front or below, where the peritoneum is absent, the urine becomes infiltrated into the cellular tissue, and gangrenous inflammation of the pelvic and perineal cellular tissue is set up. We see, therefore, that the results of wounds of the bladder are very serious. How are they to be remedied? As regards the discharge of urine into the peritoneum it is extremely difficult to treat, especially if the wound occurs when the bladder is full. Under any circumstance it is useful to introduce a catheter and allow it to remain so that the urine may pass off as it enters the bladder, and not be allowed to accumulate. In cases where the wound is situated on one of the surfaces not covered by the peritoneum, the wound should be made sufficiently large to allow the urine to pass freely externally. Tents, catheters, or tubes may be used to carry off this fluid so irritating to the tissues with which it comes in contact. In order to avoid this infiltration, it has even been recommended to cauterize the surfaces that are moistened by the urine. The proposal seems to me a reasonable one, and I should not hesitate to employ it if the heated iron, whose action so rapidly passes off, could be effectually applied to deep seated parts. It is for this reason that I prefer Conquoin's caustic, or the chloride of zinc applied in the form of a paste or upon amadou, a way in which I have successfully employed it for some years.

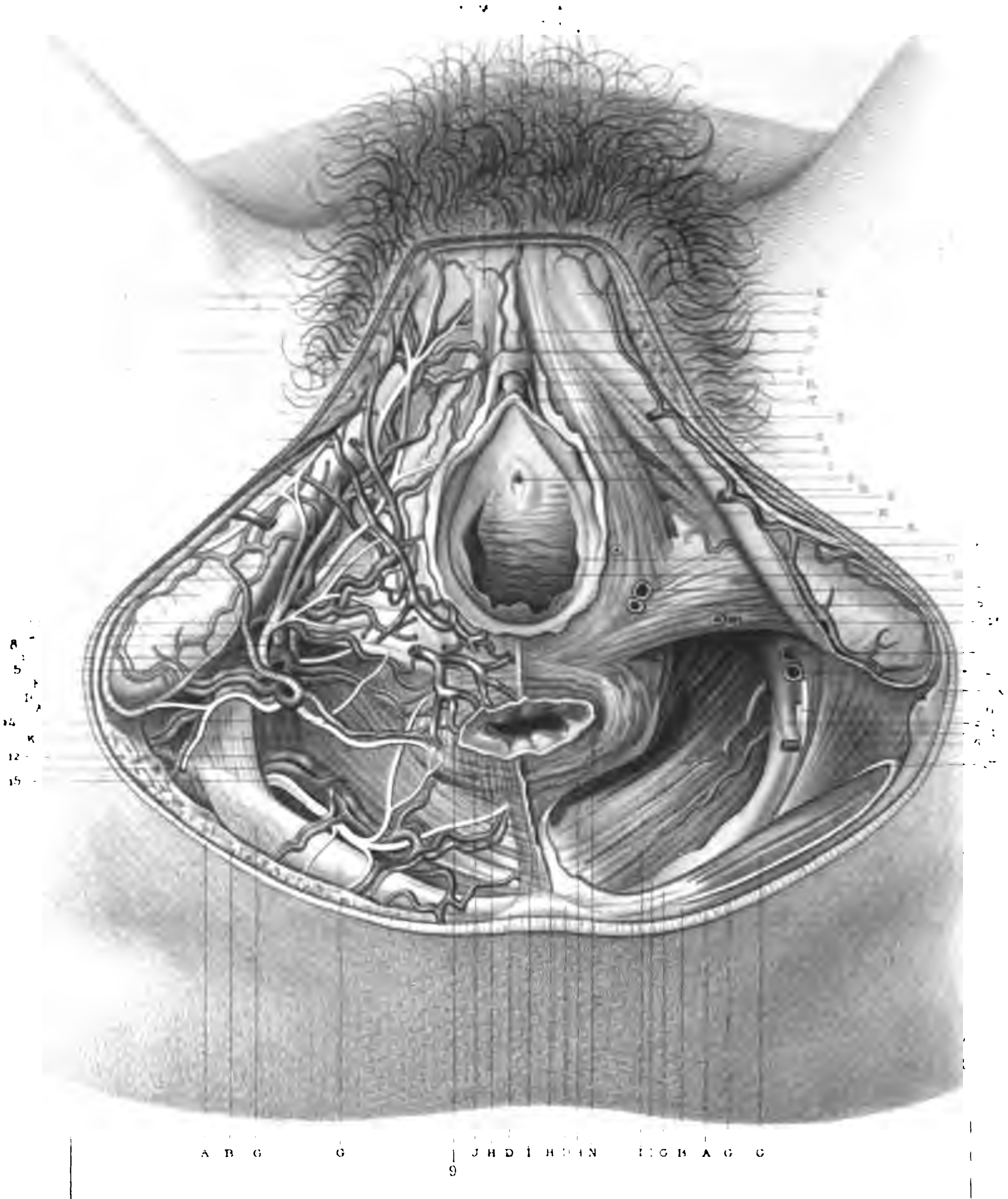
Fistulas often occur as one of the consequences of wounds of the bladder; they may show themselves: 1. in the rectum; 2. in the perineum; 3. on the walls of the abdomen near the pubis, or even opposite the umbilicus. All these varieties of fistula of the urinary bladder are accounted for by the anatomical conditions of the parts and their relations to the bladder. Some years ago I saw a patient under the care of M. Nélaton who had one of these fistulas which opened at the umbilicus; it is evident that in this case the urine had followed the course of the canal in which the urachus was contained.

Inflammation of the bladder has received the name of *cystitis*. This inflammation may vary as regards its causes, its seat, its nature, its course, and its extent. We have here only to justify the establishment of these varieties as regards their situation; thus, the inflammation may occupy a part or the whole of the mucous membrane, or it may be seated in the muscular or in the sub-peritoneal cellular tissue. When the whole of the mucous membrane is affected, it may happen here as it frequently does in the case of the uterus, that the mucous membrane exfoliates; this was noticed recently in a remarkable case seen by M. Dolbeau. This exfoliation is explained by the slight connexion which exists between the mucous and muscular layers of the bladder; this anatomical arrangement also accounts for the occurrence of hernia of the mucous membrane through the spaces between the muscular fibres, the formation of urinary pouches which cannot empty themselves because, having no contractile covering, they become more and more distended by the urine, which is driven into this accidental cavity by the action of the muscular fibres of the true bladder, which is beside it.

With regard to operative surgery, that is to say, lithotrity, we would observe that the bladder presents behind the *trigonum vesicæ* a space having a greater inclination, and which has received the name of the base of the bladder. It is necessary to pay particular attention to the situation which this part obtains in all positions of the body, and especially when the person is lying on his back, because the point of the instrument must be carried there in order to seize the stone and crush it. The surgeon introduces his instrument and then waits patiently holding it steady, and the stone from its weight falls between the blades of the lithotrite. To satisfy oneself of the success of this proceeding, it is advisable to bring the pelvis forwards and maintain it in that position either by means of assistants or a properly constructed bed. By pursuing this course there is the further advantage of not striking against the walls of the bladder, and we thus avoid bruising the organ.

On the lateral walls of the bladder is seen the spermatic duct coming from the testicle conveying the secretion of this organ into the vesicula seminalis. The presence of this canal in the pelvic cavity and on the lateral walls of the bladder affords a ready explanation of the intra-abdominal and vesical pains which accompany inflammation of the testicle or of the canal. The vesciculæ seminales are often attacked by gonorrhœal inflammation in the same way as the testicle itself, that is to say, by the inflammation being propagated along the urethra and the track pursued by the spermatic fluid, and we may convince ourselves of the existence of this complication by introducing the finger into the rectum and making pressure above the prostate, which may itself also become inflamed, following inflammation of the urethra from gonorrhœa or any other cause.

The ureter is also seen on the sides of the bladder, where it is reduced to a small trunk. It is just at this part, which is shown in the present Plate, that the canal presents a natural contraction where calculi become arrested which occasionally descend from the kidney into the bladder. As this portion of the ureter is entirely surrounded by a descending plexus of the sympathetic nerve, which I have described in the *Traité des maladies des femmes* of Becquerel under the name of *ureteral plexus*, it follows that distension of the canal by a calculus causes acute irritation of the sympathetic accompanied with severe pains and frequent vomiting, similar to those which characterise nephretic colic.



F. Bion del. [illegible] Paris

LIBRAIRIE GERMER BAILLIÈRE

PLATE LXIX.

Ano-perineal Region in the Female.

Superficial layer.

EXPLANATION.

RIGHT SIDE (*first layer*).

A. Section of the skin bounding the region.
B. Section of the fatty cellular tissue on the boundaries of the gluteal and ischiatic regions.
C. Section of the cellular tissue of the outer or greater lip.
C′. Subcutaneous fascia opposite the pubic region.
C″. Fibrous arch beneath the outer lip giving passage to the external pudic vessels anastomosing with the branches of the internal pudic.
D. Coccyx.
E. Symphysis pubis.
E′. Tuberosity of the ischium.
F. Section of the synovial capsule which is found on the ischium.
G. Aponeurosis of the glutæus maximus muscle.
G′. Aponeurotic expansion of the glutæus maximus muscle going to be inserted into the ischium.
H. Section of the mucous membrane of the anus continuous with the skin of the neighbouring parts.
I. Aponeurosis covering the posterior part of the sphincter ani and inserted into the coccyx.
J. Aponeurosis covering the circular fibres of the external sphincter muscle of the anus.
K. Aponeurosis covering the inferior surface of the elevator muscle of the anus and forming the internal and superior wall of the ischio rectal fossa.
L. Superficial aponeurosis of the perineum.
M. Superficial aponeurosis of the perineum covering the anterior extremity of the constrictor muscles of the vagina and the erector clitoridis.

1. Internal pudic artery.
2. Transverse branch of the internal pudic artery.
3. Superficial branch of the internal pudic artery.
4. Branch of the internal pudic artery anastomosing with the ramifications of the external pudic.
5. Trunk of the inferior hæmorrhoidal artery.
6. Ramifications of the inferior hæmorrhoidal artery anastomosing with the terminal branches of the obturator and ischiatic arteries.
7. Posterior branches of the internal pudic artery.
8. Internal pudic vein.
9. Plexus formed by the hæmorrhoidal veins of which the main trunk is divided.
10. Venous trunk of the hæmorrhoidal plexus emptying itself into the subcutaneous veins of the internal and superior part of the thigh.
11. Anastomosing vein passing beneath the greater lip, commencing at the posterior part of the vulva and emptying itself into the veins of the internal part of the thigh.
12. Inferior hæmorrhoidal vein.
13. Superficial nerve of the perineum with its terminal branches.
14. Posterior branch of the superficial nerve of the perineum going to be distributed around the anus.
15. Hæmorrhoidal or anal nerves.
16. Ramifications of the small sciatic nerve terminating in the labia majora.
17. Anastomosis of the small sciatic with the superficial nerve of the perineum.

LEFT SIDE (*second layer*).

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty fascia.
C. Section of the labia majora.
C′. Section of the subcutaneous fascia opposite the pubis continuous with the fascia of the labia majora.
D. Coccyx.
E. Symphysis pubis.
F. Aponeurosis covering the external wall of the ischio-rectal space beneath which are the vessels and nerves.
G. Inferior edge of the glutæus maximus muscle.
G′. Aponeurotic portion of the glutæus maximus going to be inserted into the coccyx.
G″. Superficial aponeurosis of the glutæus maximus muscle.
G‴. Angle formed by the superficial and deep aponeurosis of the glutæus maximus muscle.
H. External sphincter of the anus.
H′. Section of the aponeurosis of the external sphincter of the anus inserted into the coccyx.
I. Muscular fibres of the elevator muscle of the anus.
I′. Section of the aponeurosis of the elevator muscle of the anus.
J. Constrictor muscle of the vagina.
K. Erector clitoridis.
L. Tendons of the erector clitoridis and constrictor vaginæ muscles.
M. Posterior fibres of the transversus perinæi muscles.
N. Section of the mucous membrane of the anus continuous with the skin.
O. Section of the mucous membrane of the orifice of the vagina.
O′. Section of the mucous membrane covering the clitoris.
P. Prepuce of the clitoris.
Q. Corpus cavernosum of the clitoris.
R. Clitoris.
S. Left labium minor.
T. Union of the two labia minora
U. Remains of the hymen, carunculæ myrtiformes.
V. Meatus urinarius.
X. Anterior wall of the vagina.

1. Dorsal artery of the clitoris.
2. Section of the superficial artery of the perineum.
2′. Trunk of the internal pudic artery seen through the superficial aponeurosis of the perineum.
3. Ramifications of the superficial artery of the perineum going to the bulbus vestibuli.
4, 5. Terminal branches of the superficial artery of the perineum.
6. Section of the anal branch of the transverse artery of the perineum.
7. Section of the superficial vein of the perineum.
8. Section of the vein of the bulb forming a communication between the bulb and the superficial veins of the region.
9. Superficial nerve of the perineum.
10. Branch of the small sciatic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The skin covering this region gradually passes into the mucous membrane of the vagina and the anus; it possesses nearly all the properties of mucous membranes as regards pliability, colour and extensibility. The latter property especially comes into play when the head of the child presents itself at the vulva; when this portion of the skin is altered by acute or chronic inflammation, or by cicatrices following wounds or lacerations, it does not yield so readily, and consequently forms a considerable impediment to delivery. Hence the accoucheur may be under the necessity of dividing the margins of the vulvular opening in order to allow the head of the child to pass. This incision should be made where the resistance is greatest, and especially at the back part and below, passing somewhat obliquely from within outwards, by the side of the median line. It is curious to see how small even an extensive incision, made while the part is distended by the fœtus, becomes after delivery. It is not uncommon to see some abrasions show themselves on the surface of the skin during the passage of the head through the vulva, and that without there being any laceration of the vulvular orifice.

This skin, like the mucous membrane of the glands and the small lips, presents a large number of follicles, or rather of sebaceous glands, which produce a secretion very useful for lubricating the organs; but this secretion readily undergoes changes, and hence the necessity of removing it in order to prevent the irritation which is caused by its being retained for any length of time. The glands situated at the vulvular orifice are so numerous that they form a special layer beneath the mucous membrane; it is not uncommon to find them inflamed. During pregnancy I have frequently found them hypertrophied as well as the glands which are beneath the neighbouring skin.

The subcutaneous and submucous cellular tissue is very extensible and at certain points encloses nothing but fat. It readily inflames and then allows of the infiltration of such a quantity of fluid that the parts become enormously distended, so as even to obstruct the natural openings of the region. Inflammation of this tissue is usually circumscribed, whence the formation of abscesses in the labia majora, in the labia minora, or even beneath the skin.

In the thickness of the labia majora there is a kind of serous membrane described by M. Broca under the name of *dartos like sac*, and which here represents the tunica vaginalis. This membrane may be the seat of a hydrocele, and even of a hæmatocele in the same manner as the tunica vaginalis.

In this region there is a large number of arterial, venous and lymphatic vessels, a condition which explains the free hæmorrhage which occurs in wounds of this region even when they do not penetrate below the superficial aponeurosis. It is no doubt the laceration of these vessels during the passage of the fœtus through the vulva that produces a kind of thrombus of the vulva. During pregnancy, these vessels become congested and the general appearance of the region has a violet hue, constituting one of the anatomical signs of pregnancy which it is well to bear in mind.

The constrictor muscle of the vulva and of the vagina is, so to speak, beneath the skin, like the sphincter muscle of the anus. Morbid changes occur at the vulva precisely in the same manner as at the anus. The vaginal and vulvular sphincter may be the seat of a constriction or contraction, which is sometimes idiopathic and sometimes symptomatic of a fissure, or even of a slight crack of the vulva. This condition which either prevents or causes an impediment to coitus and to delivery, must be treated by similar means to those which are successful in fissure of the anus: we refer to incision and forcible dilitation. M. Michon has published an excellent memoir on the success obtained by forcible dilitation by means of the fingers in overcoming this affection, of which he had several remarkable examples.

Behind the meatus is seen a fleshy tubercle which is a dependence of the ridges on the anterior wall of the vagina. It is important to determine the existence of this tubercle, because when we wish to catheterise a female without the assistance of the sight, it is sufficient to introduce the finger into the vulva on the side next to the anus so as to find this tubercle in order that the point of the instrument when applied in front of it may pass into the urethra.

The entrance to the meatus is sometimes closed by a small irregular fleshy mass, whose presence causes a number of slight annoyances. The stream of urine propelled by the bladder, instead of passing out in a single jet comes against this small mass and the urine dispersed in all directions covers the neighbouring organs, producing irritation and giving rise to a chronic subinflammatory condition that is very inconvenient, and which no treatment will benefit until the original cause is removed. I have already seen two such cases, and was able to afford relief.

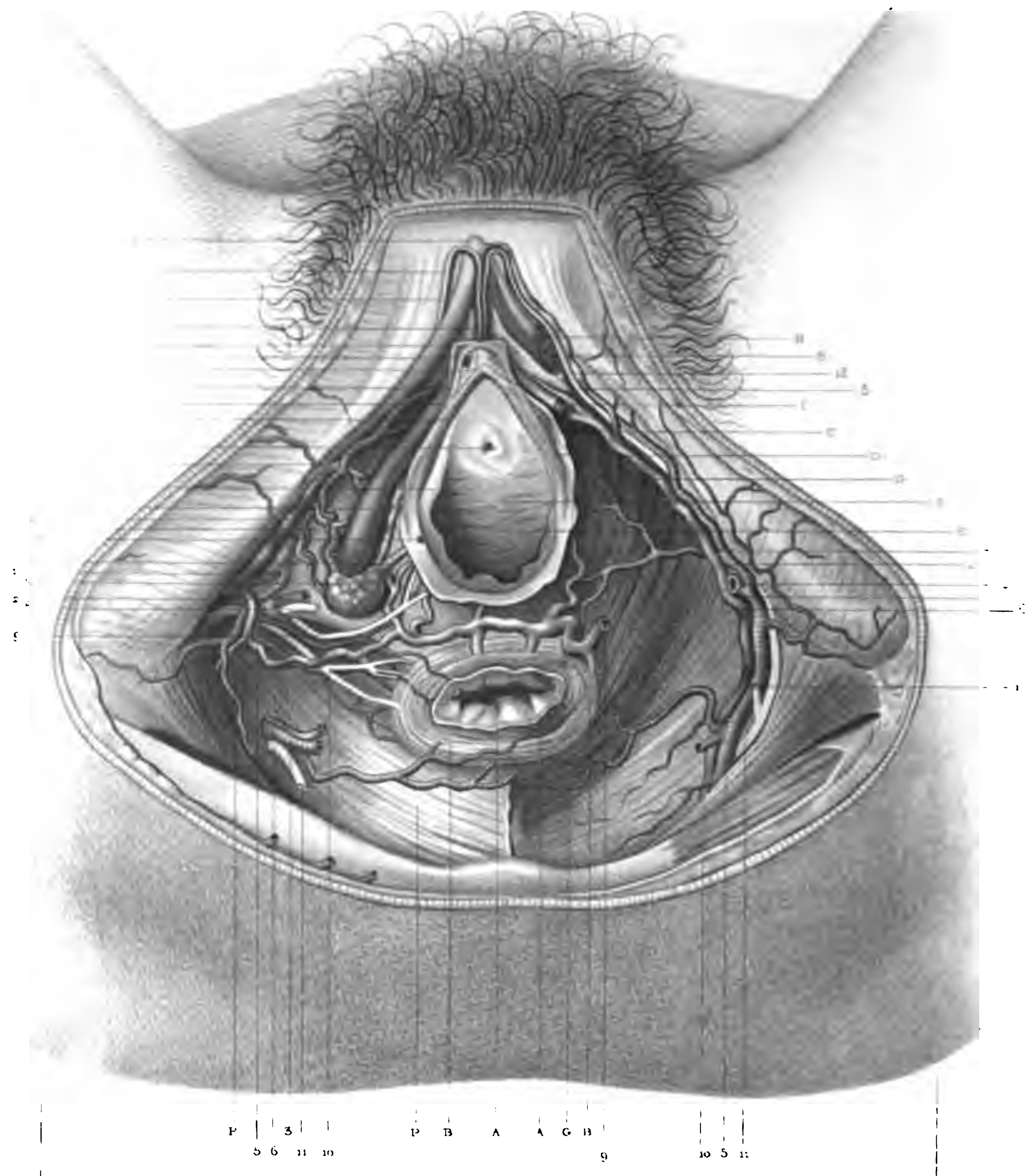
The rectum may be divided into three portions. The first is that which is covered entirely or in part by the perineum. In front it is connected with the posterior surface of the bladder, from which it is almost always separated by one or two convolutions of the intestines, which usually reach to the bottom of the vesico-rectal *cul de sac*, and it is this connexion which explains the formation of fistulæ termed *intestino-vesical*. Behind the rectum corresponds to the mass of cellular tissue contained in the fold of peritoneum termed *meso-rectal*, and which is continuous above with the cellular tissue of the abdomen, and below with the cellular tissue of the superior pelvi-rectal space. The second portion extends from where the peritoneum is wanting to the anterior extremity of the prostate. Passing obliquely from above backwards, and about eight centimetres (3·14 English inch) in length, it becomes much enlarged and corresponds to the inferior extremity of the anterior surface of the sacrum and to the anterior surface of the coccyx; it is seen to correspond to the pelvic cellular tissue and to the elevator muscle of the anus. In front it touches the base of the bladder, the ejaculatory ducts, the prostate, the vesiculæ seminales, and even the vesical extremity of the ureter; from this there arises a series of applications which serve to determine the anatomical or pathological condition of the organs. The third portion, corresponding to the sphincters of the anus, is the shortest and has connexions with the perineal region which we have already examined. It is useful to establish these distinctions, especially in regard to cancer, because if the tumour has already extended to the perineal portion, an operation is no longer practicable. When, on the contrary, the disease is confined to the two subjacent parts, or only to one of them, the operation is not equally dangerous.

The diameter of the rectum is not the same throughout; it also presents projections, valves, and folds, and it is precisely at these points that we meet with organic or syphilitic strictures.

The submucous cellular tissue is very yielding. When it is engorged it becomes hard and lardaceous, communicating to the fingers the same sensation as a cancerous tumour. This peculiarity must be borne in mind in diagnosing the nature of a tumour situated at the lower extremity of the rectum. The folds and projections of the mucous membrane of the rectum give it some resemblance to the mucous membrane of the nose, and like the latter, it is sometimes the seat of polypi of various forms, and most frequently so in children.

Other tumours, besides cancer, may affect the rectum, amongst them we may mention hypertrophied tumours, which are formed of one or more of the tissues which enter into the composition of the rectum. Thus we meet with glandular, vascular, muscular, and fibrous tumours, &c.

The rectum is placed in front of the sacrum, so that tumours of the latter part may push it out of place, compress and obstruct it, causing constipation and sometimes all the phenomena of internal strangulation. Amongst these tumours are those of a cancerous, osseous, and a cartilaginous nature. Amongst tuberculous tumours we may mention those which are associated with Pott's disease. I have at this time under my charge in the Hôpital Saint Antoine, a young man who has an enormous tumour occupying nearly the whole of the pelvic cavity, compressing not only the rectum, but also the bladder, which is pressed up into the hypogastric region. This tumour consists of a purulent collection of matter arising from tubercular disease of the sacrum or of some higher portion of the vertebral column.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXX.

Ano-Perineal Region in the Female.

Deep layer.

EXPLANATION.

RIGHT SIDE (*first layer*).

A. Section of the mucous membrane of the anus.
B. External sphincter muscle of the anus.
C. Section of the mucous membrane of the clitoris.
D. Labium minor.
D′. Union of the labia minora beneath the clitoris.
E. Membrane of the hymen and the carunculæ myrtiformes.
F. Prepuce of the clitoris.
G. Corpora cavernosa of the clitoris.
G′. Clitoris.
H. Union of the corpora cavernosa of the clitoris.
I. Commencement of the corpora cavernosa of the clitoris.
J. Bulb of the vagina.
J′. Superior extremity of the bulb of the vagina.
K. Vulvo-vaginal gland or gland of Huguier.
L. Canal of the vulvo-vaginal gland.
M. Opening of the canal of the vulvo-vaginal gland.
N. Opening of the urethra.
O. Middle aponeurosis of the perineum.
P. Superior aponeurosis of the perineum covering the inferior surface of the elevator muscle of the anus.
P′. Ischio rectal fossa.

1. Internal pudic artery.
1′. Artery of the clitoris.
2. Trunk of the superficial artery of the perineum.
3. Trunk of the inferior hæmorrhoidal artery.
4. Internal pudic vein.
5. Inferior hæmorrhoidal vein.
6. Inferior hæmorrhoidal vein accompanying the artery of the same name.
7. Nerve of the clitoris.
8. Superficial nerve of the perineum.
9. Terminal branches of the superficial nerve of the perineum.
10. Nervous branch going to the anus.
11. Hæmorrhoidal or anal nerve.

LEFT SIDE (*second layer*).

A. Section of the mucous membrane of the anus.
B. External sphincter of the anus.
C. Section of the vulvular mucous membrane.
D. Left labium minor.
E. Membrane of the hymen and the carunculæ myrtiformes.
F. Anterior wall of the vagina.
G. Anterior fibres of the elevator muscle of the anus.
G′. Posterior fibres of the elevator muscle of the anus.
H. Section of the left cavernous body of the clitoris.
I. Section of the bulb of the vagina on the left side.

1. Trunk of the internal pudic artery.
2. Artery of the clitoris.
3. Trunk of the artery of the clitoris and its connexions with the corpora cavernosa.
4. Superficial artery of the perineum.
5. Arterial branch coming from the internal pudic and anastomosing with the inferior hæmorrhoidal artery.
6. Trunk of the internal pudic vein.
7, 8. Venous branch of the clitoris and of the superior extremity of the bulb of the vagina.
9. Superficial vein of the perineum anastomosing with the right and left plexus of the region.
10. Vein accompanying the artery which establishes an anastomosis between the internal pudic artery and the inferior hæmorrhoidal artery.
11. Internal pudic artery.
12. Superficial branch of the internal pudic nerve.
13. Nerve of the clitoris.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds which involve the two deep layers, whatever their nature, present a special danger because they are liable to open the numerous vessels which ramify in the region. The arteries, veins, and bulb are so many vascular organs exposed to these accidents. Five years ago I witnessed a contused wound of the bulb which in many respects was very curious. A young woman, who had been confined about three months, mounted on a stool to clean the window, the stool having slipped from under her, she fell crossways on to the angle of the stool, which penetrated into the vulva and produced a deep wound. I was immediately called to the patient and found she had already lost a considerable quantity of blood. After washing the parts, I was able to ascertain that the bulb of the vagina had been torn. I arrested the hæmorrhage by means of the perchloride of iron. It is scarcely necessary to dwell upon the inconvenience arising from these cicatrices in respect to delivery, inasmuch as it is easily understood that not being extensible the cicatrices must generally be divided in order to allow of sufficient dilitation of the vulva.

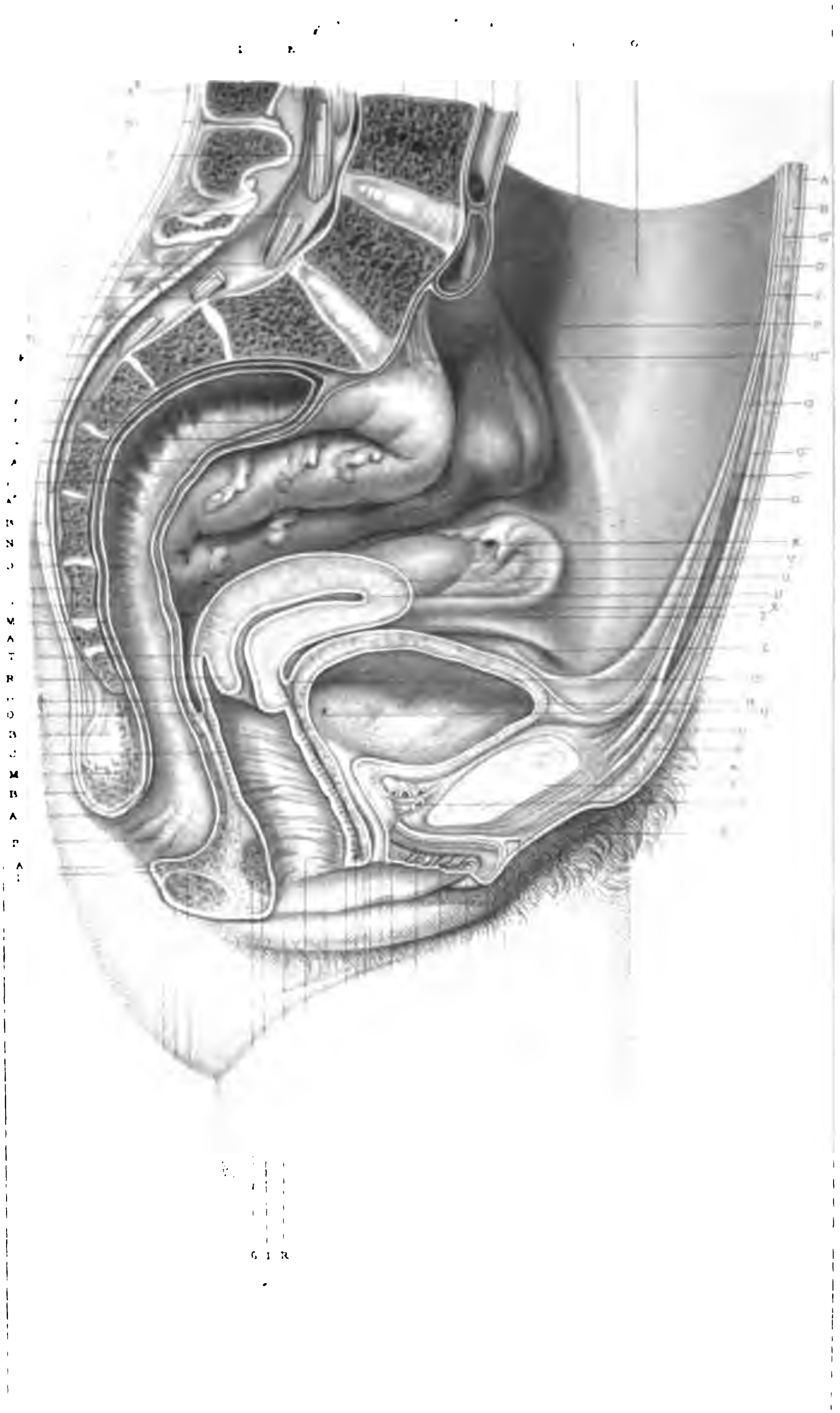
Amongst the accidents which may occur during labour, there is one whose nature and varieties are easily explained, I refer to laceration of the perineum, or rather of the perineal commissure. The frequency of this laceration may be explained by the formation of the vulva and its relations with the perineum and the axis of the pelvis. The head of the fœtus in its progress pursues such a direction that it necessarily impinges against the floor of the perineum, that is to say, first against the vaginal septum, then against the commissure of the perineum, and lastly against half the posterior circumference of the vulva, which is nothing more than the anterior margin of the perineal commissure itself. It is especially during the movements of distension produced by the head that the commissure has to sustain all the expulsive efforts of the uterus aided by the contractions of the abdominal parieties. Sometimes the muscles which enter into the structure of the perineum offer considerable resistance to dilitation, either from a spasmodic contraction, or from being relatively too powerful. In some cases this resistance arises from cicatrices, or from the presence of too large a quantity of fat in the substance of the surrounding tissue. Whatever may be the cause, if these conditions are not removed, an antagonism arises between the perineum and the uterus aided by the co-operating organs which terminates in the yielding or laceration of the perineum. These lacerations present three varieties which are explained by the anatomy of the parts. In the first degree the skin and the mucous membrane are alone involved, and then the cicatrisation takes place as it were spontaneously. In the second degree the laceration includes not only the integument, but also the subcutaneous cellular tissue, the superficial aponeurosis, and the constrictor muscle of the vagina. In this case nature is quite capable of repairing the lesion, but it is necessary to assist her by bringing the thighs together, and especially by applying the *serres fines*. In the third degree the laceration affects not only the previous organs but also the sphincters of the anus, and may reach more or less above the septum. In this case, which is much more serious, inasmuch as it is accompanied with want of retention of the fœcal matter, nature may effect a cure, but she must be effectually assisted. The approximation of the thighs, the application of the *serres fines*, and extreme cleanliness must be assiduously employed. The *serres fines* are of great service in these cases, and are much to be preferred to the ordinary suture, because they are more easily applied. If, after using these means, union does not take place, an operation must be performed, the details of which will be found in the next Plate.

It is sufficient to examine the region to see that there is no important artery in the substance of the commissure capable of giving rise to hæmorrhage. There is one large subcutaneous vein whose laceration might cause an escape of blood.

On the right side of the drawing is seen the vulvo-vaginal gland with its duct and opening. Through its orifice, which is situated below and on the side of the vulva, inflammation may spread from this to its tissue, and it is in this way we must account for the frequency of its inflammation. Sometimes the inflammation is confined to the duct, and if suppuration occurs and an abscess forms, the matter presents itself beneath the mucous membrane of the vulva, to the surface of which it soon makes its way unless the surgeon opens it by an incision. It is important to make this opening early, if we would avoid the mucous membrane getting too thin and so becoming the cause of a fistula. Sometimes the inflammation is deeper seated and reaches the gland itself. When this is the case the results are more serious, the inflammation more acute, there are some symptoms of strangulation because the gland is surrounded on all sides by bone and fibrous tissue which are both unyielding. These inflammations often terminate in suppuration and give rise to deep seated abscesses which remain hidden for a considerable time, and then present themselves simultaneously at the surface both of the skin and of the mucous membrane. They should be opened without delay through the latter membrane if we would avoid the formation of a fistula. The opening should be large, and even then cicatrisation does not take place in consequence of the surrounding fibrous tissues not uniting. Under such circumstances, I have obtained a permanent cure of the fistula by introducing into its track a small portion of Canquoin's paste.

We shall here notice, merely as a matter of fact, the situation of the nerve of the clitoris, the termination of the internal pudic nerve, which it has been proposed to divide in nymphomania. Should the surgeon wish to try this operation, the present Plate will afford him valuable indications as to the manner of its performance; the operation is not difficult. It is, in fact, sufficient to follow the course of the ischio-pubic branch and to divide the several layers one after another. When he reaches the artery and the vein he knows that the nerve is beneath the latter. He avoids wounding the bulb of the vagina and the corpora cavernosa of the clitoris by avoiding in the slightest degree the ischio-pubic branch. It has also been proposed to excise the clitoris itself as a remedy for nymphomania. This operation presents no difficulty, but we do not consider that it is effectual and should only be resorted to as a last resource, because the cause of the disease is more mental than local.

We shall say nothing concerning the rectum and the anus, since the remarks which apply to them are the same as in the case of the male, and they have been given in the preceding Plates.



F. Bion del. Debray sc.

LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXI.

Pelvic Region of the Female.

Antero-posterior section of the pelvis in the median line.

EXPLANATION.

A.	Section of the skin below the umbilicus.
A′.	Section of the skin opposite the pubis.
A″.	Section of the skin opposite the clitoris.
A‴.	Section of the skin near the anus.
A⁗.	Section of the mucous membrane of the anus.
A′′′′′.	Section of the mucous membrane of the rectum.
A′′′′′′.	Section of the skin in the lumbar and sacral regions.
B.	Section of the subcutaneous fatty cellular tissue of the anterior wall of the abdomen.
B′.	Section of the subcutaneous fatty cellular tissue opposite the pubis.
B″.	Section of the subcutaneous fatty cellular tissue opposite the sacral region.
B‴.	Section of the fatty cellular tissue opposite the anal region.
C.	Body of the fourth lumbar vertebra divided vertically.
C′, C″.	Section of the sacro-lumbar portion of the spine in the median line from before backwards.
D.	Vertical section of the spinous process of the third lumbar vertebra.
D′.	Posterior wall of the sacral canal.
D″.	Sacro coccygeal ligament continuing the posterior wall of the sacral canal which it closes below.
E.	Dura mater of the spinal cord.
E′.	Dura mater of the spinal cord in the sacral canal.
F.	Antero-posterior section of the symphysis pubis.
G.	Rectus abdominis muscle.
G′.	Tendon of the rectus abdominis muscle.
G″.	Superficial aponeurosis of the anterior wall of the abdomen forming lower down the anterior layer of the sheath of the rectus abdominis muscle.
G‴.	Posterior layer of the sheath of the rectus abdominis muscle.
H.	Wall of the bladder.
H′.	Sub-pubic fibro-vascular cellular tissue.
I.	Urethro-vaginal and vesico-vaginal septum.
I′.	Section of the constrictor of the vagina.
J.	Recto-vaginal septum.
K.	Section of the sphincter muscle of the anus.
L.	Section of the submucous cellular tissue at the margin of the anus.
L′.	Section of the peritoneum covering the anterior surface of the rectum.
M.	Posterior segment of the section of the sphincter muscle of the anus.
M′.	Vertical section of the muscular fibres of the rectum.
N.	Section of the aponeurosis and the general muscular mass.
N′.	Aponeurosis of the general mass becoming blended with the sacro-coccygeal ligament.
O.	Abdominal cavity lined by the peritoneum.
O′.	Peritoneum lining the posterior surface of the anterior wall of the abdomen.
O″.	Peritoneum covering the anterior surface of the rectum.
O‴.	Cul de sac of the peritoneum termed *vesico-uterine*.
O⁗.	Cul de sac of the peritoneum termed *utero-rectal*.
O′′′′′.	Peritoneum reflected from the vertebral column on to the large intestine and forming the fold termed *meso-colon*.
P.	Meso-colon.
P′.	Section of the anterior wall of the rectum covered by the peritoneum.
P″.	Section of the fibro-cellular membrane covering the muscular tunic of the rectum.
P‴.	Cavity of the rectum with its folds or valves.
P⁗.	Elevations and depressions of the anal aperture.
Q.	Cavity of the bladder and opening of the left ureter.
Q′.	Meatus urinarius.
Q″.	Mucous membrane of the urethra continuous with the mucous membrane of the vulva.
Q‴.	Mucous membrane of the vagina.
R.	Labium major.
S.	Labium minor.
T.	Mucous membrane of the anterior and lateral wall of the vagina.
U.	Section of the walls of the uterus.
U′.	Cavity of the uterus.
V.	Body of the ovary.
X.	Body of the Fallopian tube.
X′.	Fimbriated extremity of the Fallopian tube.
Z.	Round ligament of the uterus.
Z′.	Extremity of the round ligament of the uterus.
a.	Clitoris.
b.	Corpus cavernosum of the clitoris.
c.	Cavity of the peritoneum.
d.	Cavity of the arachnoid membrane of the spinal cord.
d′.	Opening for the passage of the sacral nerves.
1.	Aorta.
2.	Artery of the clitoris.
3.	Left common iliac vein.
4.	Venous plexus at the neck of the bladder.
5.	Venous plexus between the bulb and the vulva.
6.	Section of the vascular plexus of the vagina communicating with the bulb of the vagina.
6′.	Hæmorrhoidal vascular plexus.
7, 8, 9, 10, 11.	Sacral nerves issuing from the vertebral canal.
12, 13.	Nerves of the clitoris and of the pubis.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

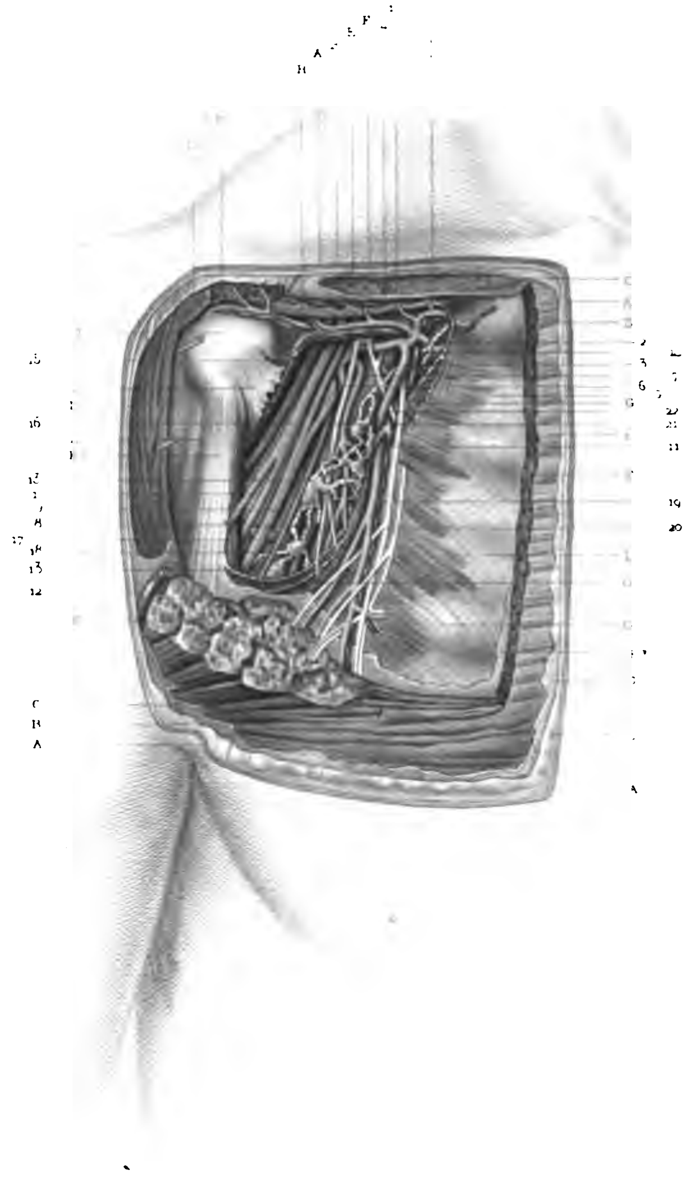
This Plate represents not only the whole of the intra-pelvic organs and their exact relations to each other, but also the general direction of the pelvis, its natural inclination, its antero-posterior diameter, and those of the pelvic cavity and of its superior and inferior openings as well as the direction of its axis, so that it furnishes most important information to the accoucheur with regard to the mechanism of parturition.

From amongst the numerous inferences which may be drawn from this Plate relating to pathology and operative surgery, we shall first fix our attention upon the vesico-vaginal and recto-vaginal septa. The mere examination of the relations of the generative apparatus with the urinary affords an explanation of a number of distinctions which have been established in pathology. Thus we perceive that the urethra may communicate with the vagina; whence we have the term of *urethro-vaginal fistula*. The space between the bladder and the vagina allows of the establishment of vesico-vaginal fistulæ. Those which are situated anteriorly are more easily cured than those situated posteriorly near the commencement of the urethra and the base of the bladder, where the urine more readily collects. There are instances in which the orifice of the urethra is situated in the fistula itself, so that in applying the suture, we include it in the margins of the wound and it forms an obstacle to their union and renders cicatrisation impossible. The relations of the uterus with the bladder also shows us that other varieties of urinary fistulæ may occur. Thus when the base of the bladder communicates with the cavity of the neck of the uterus we may have a *vesico-uterine* fistula. Sometimes the urine does not reach as far as the mucous membrane of the neck or body of the uterus, it passes in front of the neck, or into the substance of the anterior lip, and then we have those varieties of urinary fistulæ described by M. Jobert de Lamballe under the name of *superficial vesico uterine fistulæ* and *interstitial vesico-uterine fistulæ.* These different varieties have suggested to the surgeon of the Hôtel Dieu rational and appropriate methods of treatment which have been confirmed by experience and by the success which has attended them: we refer to obliteration of the uterus in extreme cases, and to the use of the suture in simple cases accompanied by paring of the surface of the lateral parts.

In regard to these fistulæ as well as in regard to recto-vaginal fistulæ, of which we are about to speak, there is one rule from which we should never deviate, and that is, never to interfere by operation until we are satisfied that nature alone is unable to effect a cure. How often have serious operations been performed, when a certain amount of care, and a judicious delay would have accomplished a permanent cure, or such an amount of improvement that a trifling operation would be sufficient to complete the cure. It is not long since we saw at the Maternity Hospital a large vesico-vaginal fistula cured by the employment of ordinary means only, such as keeping a catheter at first in the bladder, and afterwards cauterising the part two or three times with the nitrate of silver.

We will now speak of recto-vaginal fistulæ, and of rupture of the recto-vaginal septum, and of the perineum. Recto-vaginal fistulæ may be pathological or traumatic. The first arise from all kinds of ulceration, from the softening of tumours, such as cancer, tubercle, &c. It is hardly possible to cure these kinds of fistulæ, unless we remove the cause which produced them. We know that we have no remedy for cancer, or tubercle, so that the fistulæ which accompany these morbid growths are almost beyond the resources of art. With regard to fistulæ which follow syphilitic tumours, or primary ulcerations, they may be cured by appropriate treatment; if they continue after this treatment, it will be advisable to pair the edges and apply a suture, and if necessary to lay them open. In regard to fistulæ following wounds, they are most frequently produced during labour. Some women are predisposed to these fistulæ from having an extremely narrow septum. I saw a woman at the Maternity who possessed this peculiarity to a great degree. It is easily understood that when this is the case, the septum is torn by the slightest effort when the head of the child reaches the floor of the perineum. It is very rarely that the fistula is simple, it is almost always accompanied by rupture of the perineum, and the septum is then divided to a greater or less extent. In one case in which I operated, the septum was torn to within two centimetres (·787 English inch) of the inferior lip of the undescended uterus.

With regard to the direction, form, situation and structure of the uterus much might be said, but we shall merely remark that in this Plate may be seen the exact relations of this organ with all the surrounding organs, and particularly with the peritoneum; so that if, for instance, you were desirous of removing the neck of the uterus, either entirely or in part along one of its lips, you would have an exact knowledge of the parts which are or are not covered by the peritoneum. These relations also explain why the weight of the viscera and of the intestines in particular have a tendency to push the uterus downwards, and why by sustaining the weight of the intestinal mass by means of a girdle called *hypogastric,* you relieve the uterus which then resumes its proper position in the pelvic cavity.



E. Beau del. Debray

LIBRAIRIE GERMER BAILLIERE

PLATE LXXII.

Region of the Axilla.

Anterior wall.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Section of the superficial aponeurosis of the pectoralis major muscle.
D. Superficial aponeurosis of the deltoid muscle.
D′. Fibres of the deltoid muscle.
E. Section of the lowermost fibres of the platysma myoides muscle covered by an aponeurotic layer, derived from the superficial fascia.
F. Sternal fibres of the pectoral muscle.
F′. Section of the fibres of the pectoralis major muscle.
F″. Section of the fibres of the pectoralis major muscle passing from the clavicle.
F‴. Section of the fibres of the pectoralis major muscle going to be inserted into the humerus.
F⁗. Deep aponeurosis of the pectoralis major muscle.
G. Section of the pectoralis minor muscle enclosed in an aponeurotic sheath.
G′. Tendon of the pectoralis minor.
G″. Inferior fibres and tendinous insertion of the pectoralis minor muscle.
G‴. Tendinous insertion and superior fibres of the pectoralis minor muscle.
H. Clavicular and pectoral aponeurosis situated in front of the axillary vessels.
I. Intercostal muscles covered by their aponeurosis.
J. Coracoid process.
K. Tendon of insertion of the coraco-brachialis muscle.
L. Tendon of insertion of the short head of the biceps.

1. Axillary artery.
2. Anterior or short thoracic artery.
3. Branch of the anterior thoracic artery going to the pectoralis major muscle.
4. Branch of the anterior thoracic artery going to the pectoralis minor and to the vicinity of the coracoid process.
6. External or long thoracic artery.
7. Accessory artery of the external thoracic.
8. External thoracic artery at the lower part of the region.
9. Axillary vein.
10. Anterior thoracic or pectoral veins.
11. Pectoral vein going to join the axillary vein.
12. Cephalic vein.
12′. Lymphatic gland in the middle of the axilla.
13. Lymphatic gland in the inferior part of the axilla.
14. Afferent lymphatic vessel of the axillary glands.
15. Radial nerve.
16. Musculo-cutaneous nerve.
17. Median nerve.
18. Internal cutaneous nerve.
19. Anterior thoracic nerve of the pectoralis major.
20. Anterior thoracic or pectoral nerve going to be distributed to the pectoralis major.
21. Anterior thoracic nerve going to the pectoralis minor.
22. Anterior thoracic nerve going to the superior fibres of the pectoralis minor.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

A simple inspection of the anterior wall of the axilla shows that superficial wounds will vary according as to whether they pass through the subcutaneous cellular tissue, the anterior aponeurosis of the pectoralis major, the pectoralis major itself, and the pectoralis minor towards the middle portion of the region. These wounds do not present any special character, but that is not the case with those which penetrate this wall so as to reach the hollow of the axilla, or when they enter the cavity of the chest. In fact these wounds are often accompanied by injury of the veins, nerves, or arteries which are found in this region, or in the cavity of the thorax. The presence of large arteries and veins (see 2, 3, 4, 9, 10) in this part shows that such wounds will sometimes be complicated with hæmorrhage.

Inflammation of the anterior wall of the axilla also presents nothing peculiar, but is the same as in other parts of the body. It must, however, be observed that some of these inflammations commence in the breast, particularly in the female, and the vicinity of the hollow of the axilla, or of the thoracic cavity gives them an importance they would not possess in other regions.

Abscesses are not uncommon in the anterior wall of the axilla. We meet with acute abscesses and chronic abscesses, with idiopathic and symptomatic abscesses. The latter may have their commencement in the neighbouring bones, such as the ribs, sternum, or clavicle, or even the vertebral column. Each of these abscesses may present a special character. Thus, an abscess which comes from the sternum will be subcutaneous because in spreading over the ribs it is placed between the skin and the aponeurosis of the pectoralis major which prevents its passing deeper inwards. Abscesses coming from the ribs or the clavicle as well as those which originate from the vertebræ will be situated beneath the pectoralis major where they are guided by the aponeurotic layers of the region. Only an abscess of the superficial surface and situated on the anterior and superficial margin of the clavicle can make its way beneath the skin.

In tying the axillary artery below the clavicle, it is usual to make the incision parallel to the anterior edge and two centimetres (·787 English inch) below the bone. In order to reach the axillary artery it is necessary to pass through the whole thickness of the wall of the axilla. This Plate shows the order in which the organs are arranged from the superficial to the deep parts. Thus, the knife would successively divide the skin, the subcutaneous cellular tissue, the superficial fascia including between its layers the lowermost of the fibres of the platysma myoides, the anterior aponeurosis of the pectoralis major, the fibres of the muscle, and the posterior aponeurosis of the muscle, which also invests the pectoralis minor muscle. In order to take this course, some surgeons recommend that the incision should be made parallel to the fibres of the pectoralis major and pass between the fasciculi of this muscle. This method seems to us to be difficult of execution, because the contraction of the fasciculi through which we pass greatly impedes the proceeding, already difficult, on account of the depth at which the axillary artery is placed. We, therefore, prefer making the incision parallel to the clavicle, and in order to render the artery more accessible, we recommend that the arm should be separated from the side of the body.

Whichever plan is pursued, certain precautions must be taken before dividing the posterior aponeurosis, sometimes termed clavi-pectoral, of the pectoral muscle. This aponeurosis should not be divided until the bleeding from the vessels in the thickness of the muscle through which we have passed is arrested. This aponeurosis is in direct contact with the axillary vein, to which it gives a fibrous sheath and thus favours the access of air into the veins. To prevent this accident, the following is the way in which I open this vein in my course on operative surgery. With a fine, but at the same time strong pair of forceps, I raise up the fibrous layer, and when I have satisfied myself of the complete separation between the vein and the aponeurosis, I make a small incision on the inside over the vessel. Through this opening, I introduce a grooved sound into the inferior segment which always separates from the axillary vein more easily than the superior. I afterwards open the superior segment. It is there that the surgeon discovers the vasculo nervous plexus. We have preserved these connections with the greatest exactness. It is seen that the vein first presents itself to the notice of the surgeon, and it is so large and so swollen by the dissection, that it completely hides the artery. Observe also, that large veins abutting upon this render the operation very difficult and it is rarely that all hæmorrhage can be avoided. When we have arrived thus far, it is necessary to separate the axillary vein and carry it forwards and downwards. For this purpose, the external wall of the vein must be laid hold of and separated from the artery by the grooved sound. When this separation is accomplished the vein is seized with a blunt hook and held downwards. Passing backwards, we meet with the artery which is tied in the usual way. The nerves are very prominent and more behind. It frequently happens that these nerves are mistaken for the artery, but such an error is never committed but by those who have not frequented the dissecting room.

The intimate connexion existing between the artery and the vein at this point, readily explains the possibility of the formation of arterio-venous aneurisms, which we sometimes meet with in this region.

Let us remember that the relations of the vein and of the artery to the subclavian muscle and the clavicle explain the possibility of arresting the flow of the blood to the superior extremity by forcibly depressing the head of the shoulder. It is evident that by this movement the vessels are compressed between the first rib and the inferior surface of the clavicle.

With regard to dislocations of the humerus into the axilla, it is seen that the head of the humerus will raise up this anterior wall, and that the more it is carried inwards towards the median line, the greater will be the elevation in consequence of the curve described by the parieties of the thorax in this region. It is unnecessary in our opinion to insist upon the possibility of the thoracic organs being wounded when the anterior wall of the axilla has been penetrated.

In regard to organic lesions of the axilla, we may say that generally these lesions under the form of tumours, such as encephaloid tumours, glandular tumours, &c, come more from the side of the inferior wall of the axilla than from the anterior wall, which is not only thick but formed of fibrous tissue.

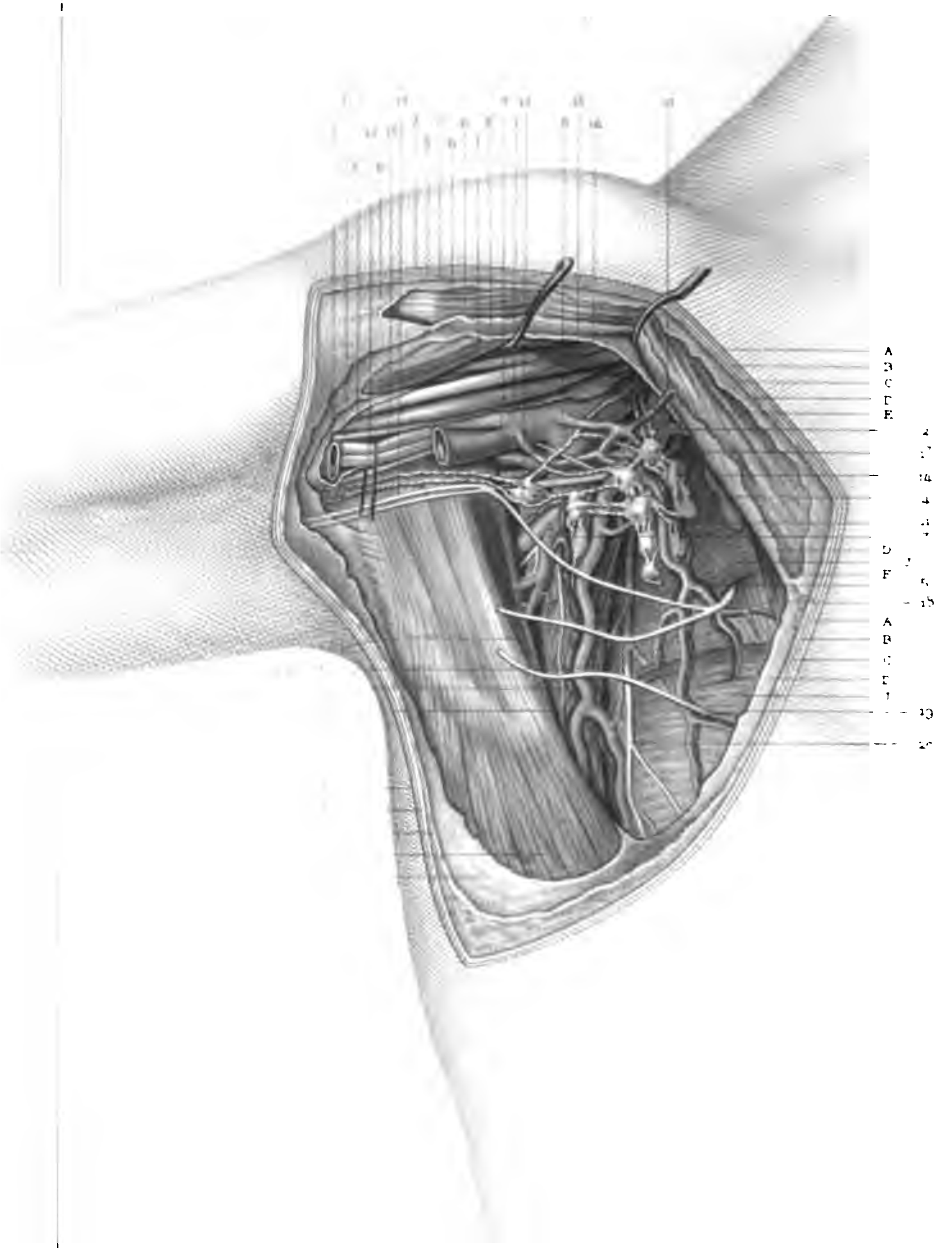

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PLATE LXXIII.

Region of the Axilla.

Hollow of the axilla.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Section of the subcutaneous fatty cellular tissue.
D. Anterior aponeurosis of the pectoralis major.
D′. Deep or posterior aponeurosis of the pectoralis major formed by the reflection of the superficial aponeurosis of the same muscle.
D″. Aponeurosis of the latissimus dorsi continuous with the aponeurosis of the pectoralis major at its most internal part.
E. Muscular fibres of the pectoralis major enclosed in their aponeurotic sheath and forming the inferior and anterior margin of the hollow of the axilla.
E′. Aponeurosis or sheath of the pectoralis major continuous with the aponeurosis of the arm.
E″. Aponeurotic layer formed by the union of the aponeuroses of the pectoralis major and minor, and of the coraco brachialis muscles and forming behind the inferior margin of the suspensory ligament of the axilla.
E‴. Aponeurosis of the arm forming the sheath of the axillary vessels at the lowest part of the region.
F. External and inferior border of the pectoralis minor muscle.
G. Muscular fibres of the latissimus dorsi forming the posterior border of the hollow of the axilla.
H. The most internal portion of the teres major muscle forming above the posterior border of the hollow of the axilla.
I. Coraco-brachialis muscle contained in its aponeurotic sheath.
J, J. Anterior fasciculi of the serratus magnus muscle.

1. Axillary artery.
2. Inferior scapular artery.
3. Branch of the inferior scapular artery.
4. Internal or long thoracic artery.
5. Branch of the external thoracic artery.
6. External thoracic before its termination in two branches.
7. Circumflex artery.
8. Anterior thoracic vein emptying itself into the axillary vein.
9. Section of the axillary vein.
10. External thoracic vein.
11. Anterior thoracic vein divided.
12. Lymphatic gland of the axilla receiving the deep lymphatic vessels of the superior extremity.
13. Lymphatic gland receiving the lymphatic vessels of the anterior thoracic region.
14. Another lymphatic gland receiving the lymphatic vessels of the anterior thoracic region.
15. Nervous trunk of the brachial plexus giving rise to the musculo-cutaneous and median nerves.
16. Radial nerve.
17. Accessory nerve of the brachial internal cutaneous.
18. Anastomosis of the intercostal nerve with the internal cutaneous.
19. Recurrent branch of the fourth intercostal nerve.
20. External thoracic nerve.
21. Brachial internal cutaneous nerve.
22. Ulnar nerve.
23. Nervous branch of the subscapular muscle.
24. Branch of the brachial plexus forming the origin of the median nerve and forming in front of the axillary artery a kind of nervous sheath.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

With regard to this region we must establish two layers: the one superficial, the other deep. In the superficial layer, included between the skin and the organs contained in the axilla, we encounter the same lesions and the same diseases as in the rest of the body. We shall only remark upon what is special to the part. Thus in the thickness of the skin and in the subcutaneous tissue, M. C. Robin has mentioned the existence of special glands which secrete an alkaline matter that reddens the clothes when it is abundant. These glands when they are inflamed give rise to abscesses which from their rounded form have received the name of *tuberous abscesses* (*abcès tubéreux* Velpeau). When they are hypertrophied they form tumours of some size. M. Velpeau (*Gazette des Hôpitaux* 16 Juillet, 1864), published a very remarkable instance of this. These abscesses speedily project beneath the skin, because below them is the aponeurosis forming the hollow of the axilla which is very unyielding.

In regard to the deep seated organs of the hollow of the axilla, there are numerous applications to pathology and operative surgery.

Mechanical lesions of these organs, such as contusions, wounds, and lacerations, are very frequent. Speaking only of wounds, we must observe that although these organs are protected behind, above, and externally by the bones of the region, they are exposed at the anterior wall of the axilla, as we have already shown. The connexion existing between the vessels and nerves, whose numbers are very considerable, explains the dangers attending wounds in this region. The danger often first shows itself by the hæmorrhage coming from the arteries or from the veins. The trunks which may be wounded are the axillary artery and vein. The secondary vessels are also sometimes wounded and give rise to a dangerous hæmorrhage.

The hollow of the axilla is deep and irregular, it is not uncommon to find foreign bodies lodged there, and overlooked.

Deep suppurations in the axilla are not uncommon after inflammation of the glands. In these cases the spontaneous opening of the abscess may present many curious varieties. Thus the pus being retained by the aponeurosis which forms the hollow of the axilla below becomes arrested in its progress in that direction; it therefore gradually raises up the entire mass of the floor of the axilla, and sooner or later makes an exit for itself at the surface of the region. It is not uncommon for the pus to form a passage along the side of the chest. Lastly, confined below by the floor of the axilla, bounded in front by the anterior wall of the axilla, and behind by the scapula, the latissimus dorsi and teres major muscles, as well as by the scapulo-humeral articulation, the pus finds an easy passage by the side of the chest, that is to say it perforates the internal wall of the cavity of the axilla, whose form is that of a pyramid. It is sufficient in fact to examine this wall in Plate LXXIII to account for this result. This wall is formed by large muscles, not very thick and arranged in fasciculi like the serratus magnus The nerves also emerge from this wall and traverse the axilla, and numerous vessels either emerge from or enter through it. These form so many conductors of the pus to the interior of the chest. It is unnecessary to insist upon the danger which accompanies these abscesses and especially of the extreme importance of opening them at once. In performing this operation, the limb should be placed in the position represented in the Plate. The knife should be carried towards the lower part of the region. This plan prevents our wounding any of the important organs contained in the axilla.

Communicating above with the hollow beneath the clavicle, connected with several bones, and with one articulation, the cavity of the axilla forms the common centre of symptomatic collections of pus varying as to their origin and nature; but it is unnecessary for us to dwell longer on these collections of pus which generally behave much in the same manner as the abscesses of which we are about to speak. Some of them, however, open spontaneously on the anterior wall of the axilla. This was the case in a patient under our care in the Hôpital Saint Antoine who had disease of the shoulder joint. Chronic abscesses, such as succeed suppuration or the destruction of glands which have been the subject of tubercle or cancer, or which have become diseased from poisonous wounds, often give rise to fistulæ which take a long time to heal up. This fact is explained, not only by the nature of these diseases, but also by the length of the track traversed by the pus and by the irregular course it pursues.

The vicinity of the scapulo-humeral articulation, the contusions to which the axillary artery is liable in the forced movements of the joint against which it is immediately placed, the shortness of its course, and moreover its tenseness and the absence of all curvature, its exposed condition anteriorly where it is imperfectly protected, are all so many causes accounting for wounds of the artery, wounds which often prove fatal, in consequence of the size of the vessel, and of which a cure can hardly take place without the production of some one or other of the different forms of aneurism. When this disease exists, the only remedy is ligaturing the subclavian artery on the outer side of the scaleni muscles.

Organic lesions, such as glandular swellings, cancer, or cysts are not uncommon in the axilla. Changes in the glands are the most frequent because they are consecutive to diseases of the mammæ. When this organ is attacked with cancer, the axillary glands soon become affected. When they are much enlarged and numerous they contra-indicate the performance of an operation. Before operating, the surgeon should ascertain whether they are simply engorged or actually in a cancerous condition, it is not, however, always easy positively to determine this question. Sometimes a complete continuation is established between the disease of the breast and that of the axilla by the enlarged and indurated glands. The same incision when extended from the breast to the axilla may serve for the removal of the diseased glands. Their removal should not be accomplished with the knife, which by dividing the vessels would inevitably give rise to hæmorrhage, it is better to enucleate them, or tear them away with the fingers; by which means this complication may be avoided.

With regard to operations, little remains to be said after having spoken of the opening of abscesses and the enucleation of the glands. When we wish to tie the axillary artery in the hollow of the axilla, the arm must be separated from the body so as to expose the region. The region is then divided into three portions, and at the union of the first with the second following the course of the artery, a suitable incision is made, passing successively through the skin, the fascia, and the aponeurosis which must be cautiously divided by a series of scratches. The vein is then drawn down and the artery exposed which is carefully tied from behind forwards on a grooved director.

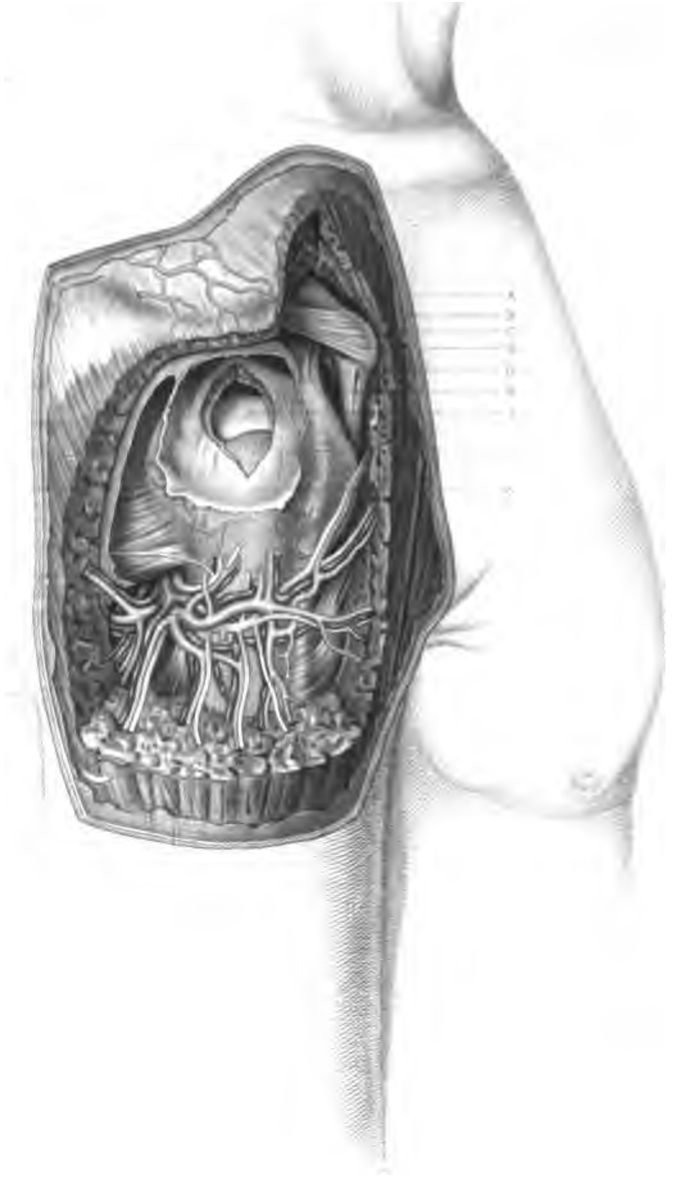

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PLATE LXXIV.

Scapulo-humeral Region.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous cellular tissue.
C. Aponeurosis of the deltoid.
D. Fibres of the deltoid muscle.
D′. Section of the muscular fibres of the deltoid.
E. Tendon of insertion of the infra-spinatus and of the teres minor muscles.
F. Aponeurosis beneath the deltoid separating the deltoid from the infra-spinatus and teres minor muscles.
G. Coracoid process where is seen the insertions of the coraco-acromial and coraco-humeral ligaments.
H. Coraco-humeral ligament.
I. The head of the humerus seen through an opening in the capsular ligament of the shoulder joint.
J. Capsular ligament of the shoulder joint.
K. Serous bursa beneath the deltoid open and extending beneath the acromio-coracoid arch.

1. Circumflex artery.
2. Circumflex vein.
3. Circumflex nerve with its terminal branches.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds of the head of the shoulder are not dangerous when they are superficial. When deep they may reach the shoulder joint, the humerus, or the scapula, or they may penetrate to the circumflex vessels giving rise to a special danger. Projectiles, such as cannon-balls, bullets, or portions of shell, are often the cause of these accidents, because the head of the shoulder forms a projection which is frequently on a level with the cannon or musket when it is discharged. These wounds are more dangerous because foreign bodies, such as splinters, blood, or pus being covered by the thick layer of the skin and by the deltoid, they cannot make their way out, and require large openings to be made, and very frequently counter openings.

It is precisely on account of its projection, that the head of the shoulder is so liable to contusions of which the effects may be merely local, or may extend to a distance. If the contusion occurs when the arm is placed close to the body, the articulation is more easily involved; while, in the contrary condition, it is the bones forming the acronical arch which receive the shock and transmit it to the clavicle, which breaks if the force is sufficiently great. If the contusion is local, its effects will fall upon the deltoid, or the articulation, or even upon the vessels and nerves of the deltoid, that is, upon the circumflex vessels and nerves. Under these circumstances there may be inflammation of the joint, paralysis of the deltoid, or an effusion of blood beneath the deltoid. The serous bursa beneath the deltoid, which varies in the manner we have previously described, is sometimes the seat of a serous or sanguineous effusion after contusions; its situation readily accounts for these results. Being situated beneath the deltoid, these sanguineous effusions are often overlooked and in consequence of the thickness of the muscle which conceals them, their existence is only slowly disclosed by the discolouration which shows itself behind the shoulder towards the lowest part of the axilla. When they are large and not recognised, these effusions of blood may remain for a long time and even increase, putting on the appearance of a malignant tumour, for which they have been mistaken, and a serious operation performed which might have been avoided if the true nature of the affection had been recognised.

Although deeply situated, the upper part of the humerus is nevertheless exposed to fractures, both direct and indirect. These fractures occur sometimes at the anatomical and sometimes at the surgical neck of the bone. The latter are the most common and are accompanied by a displacement which is readily accounted for by an examination of the region. In fact, the lower portion of the bone is drawn inwards and upwards, that is, into the hollow of the axilla, by the action of the pectoralis major muscle. The superior portion, on the contrary, remains *in situ*, being retained by forces which counteract the action of this muscle These fractures are therefore recognised by the crepitation and by the projection which can be felt in the axilla. To reduce the fracture, the elbow must be brought in front of the trunk and a little upwards, and maintained in this position by a proper bandage.

Displacement of the head of the humerus in dislocations inwards may occur in various degrees. Thus, in the first degree, the head of the humerus is placed beneath the coracoid process, it is the sub-coracoid dislocation. In a further degree, the head is placed within the coracoid process, it is then the intra-coracoid dislocation. It has been debated in the case of the sub-coracoid dislocation whether there was shortening or lengthening of the limb, it is sufficient to consider the situation of the coracoid process in relation to the glenoid cavity to be convinced that the head of the humerus being lodged beneath the process, it must be rather lengthened than shortened. But this elongation can only be very slight, in consequence of the interposition of the soft parts, and the inclination of the articular surfaces against each other. The relation of the circumflex nerve to the surgical neck of the humerus shows that the nerve may be contused or even completely divided. In fact, the irregularities of the two fragments act as lacerating bodies and render these wounds very frequent. When the deltoid is paralysed in consequence, it may become atrophied to a greater or less extent throughout the whole or only a portion of its fasciculi and the osseous surfaces are then felt as if they were placed immediately beneath the skin. Moreover, sometimes this atrophy is such that the bones project beneath the skin, and if in these cases the surgeon is not careful he mistakes these projections for the result of a badly united fracture.

Let us make a few remarks upon the organic lesions of the upper part of the shoulder. These diseases are very frequent and may be situated in the skin, the subcutaneous fatty cellular tissue, or the deltoid muscle; sometimes they are deeper seated either in the articulation or in the bones of the region. The first consist of cysts, lipomas, or cancers. Lipomas or fatty tumours are very frequent at the upper part of the shoulder. I recently removed one the size of a fœtal head. The deltoid muscle is liable to atrophy, either as a consequence of contusions or of rheumatism. The superficial organic lesions possess a remarkable character, if the lesion arises from the bone where the tendon of the biceps passes through the articulation, the latter forms an impediment to the development of the tumour, and we perceive that it is bilobed and that the groove of separation is exactly in the course of the long head of the biceps. We have been able in such a case to declare that the seat of an encephaloid tumour was in the humerus from the inference to be drawn from this character alone.

Of the various organic lesions which attack the deep-seated organs, we shall speak of scapulagia. This disease, which is sometimes caused by arthritis, at other times by inflammation, caries, or necrosis of the various bones which enter into the articulation or are situated in the vicinity of it, often gives rise to consecutive abscesses whose course and progress towards the skin is easily inferred from an examination of the organs which enter into the structure of the region. Thus, at one time the pus will pass forwards beneath the pectoralis major, at another outwards and downwards beneath the deltoid, sometimes backwards in the sheath of the supra and infra-spinatus muscles. The precise situation of the suppuration gives rise to a certain course. Thus, if the lesser tuberosity is the seat of the disease, it can take no other course than towards the deltoid; if it is the greater tuberosity which is affected, the pus will pass towards the posterior wall of the axilla, or beneath the deltoid; if it is the glenoid cavity or the coracoid process which is involved, then the pus will collect in the axilla. If all these parts are diseased the pus will spread in every direction; this is what has occurred in a patient under my care at the present time in the Hôpital Saint Antoine. The depth and numerous seats of the disease and the danger of the operation form so many difficulties and objections to the operation of resection in this disease which is always of a very long duration. However this may be, if the disease is circumscribed, if the lesion is superficial, we should be justified in performing resection of the articulation. Various methods of proceeding have been employed for its performance; we must refer for a description of them to the thesis of M. Beau, entitled: *De la scapulalgie et de la résection scapulo-humérale*, Paris, 1860.

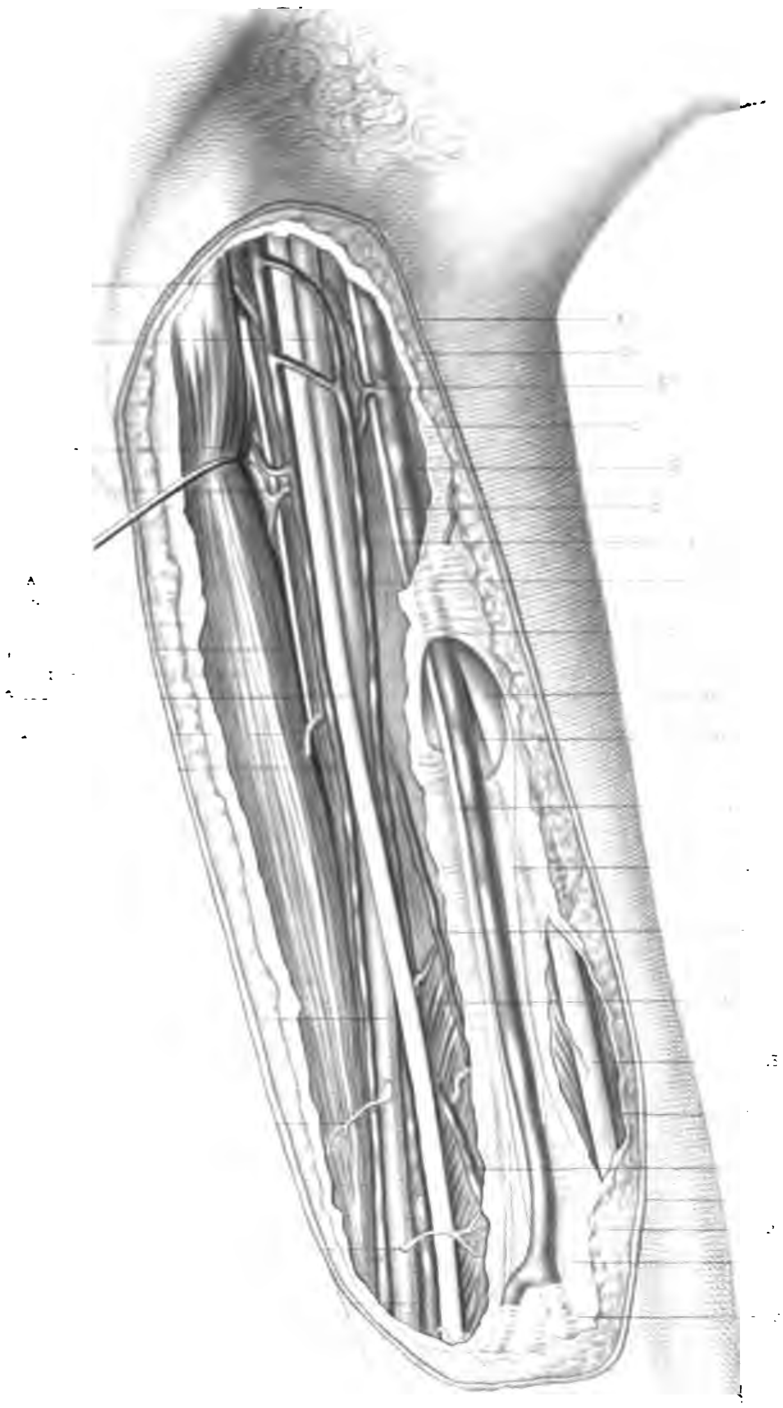

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PLATE LXXV.

Humeral or Brachial Region.

Internal surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Superficial aponeurosis or covering of the brachial region.
C′. Deep layer of the superficial fascia forming a special sheath for the superficial veins at the inferior part of the region.
C″. Fibrous arch giving passage to the median vein which from being superficial becomes sub-aponeurotic.
D. Biceps or attendant muscle of the brachial artery.
E. Internal fibres of the brachialis anticus muscle.
F. Inferior fibres of the coraco-brachialis muscle.
G. Fibres of the internal portion of the biceps muscle.

1. Brachial artery.
2. Branches furnished by the brachial artery going to the biceps.
3. Muscular branch of the brachial artery going to the fore-arm.
4. Internal brachial vein.
5. External brachial vein.
6. Basilic vein passing through the arch of the brachial aponeurosis.
6′. Basilic vein in its course beneath the aponeurosis.
6″. Anastomotic vein between the internal brachial and the basilic vein.
7. Deep vein joining the internal brachial.
7′. Muscular vein joining the external brachial.
7″. Another muscular vein coming from the anterior brachial to join the external brachial.
8. Median nerve.
9. Musculo cutaneous nerve.
10. Ulnar nerve and its relation to the basilic vein.
11. Internal cutaneous nerve.
12. Accessory nerve of the internal cutaneous.
13. Ulnar nerve at the lower part of the region.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds of the internal surface of the arm are very dangerous when they are deep, because they may involve the vessels and nerves traversing the region. It is true that these organs, which are of such great importance, are so protected by their position on the inner surface of the arm from external violence, that the humerus must be broken before a blow or a projectile can reach them. A blow coming directly from before backwards when the arm is close to the body could not injure these vessels and nerves without at the same time dividing the inner edge of the biceps. Nevertheless, these organs are liable to be wounded not only under the extreme conditions of which we have just spoken, but also directly by a blow directed against the inner surface of the arm when the upper extremity is separated from the trunk and in the position of abduction.

When the brachial artery is wounded in the middle part of its course, the hæmorrhage may be readily arrested by compressing the artery against the humerus either by means of the fingers or the tourniquet, in consequence of their close proximity to each other. The relation of the median nerve to the artery at the middle of the arm, whether it passes behind or in front of the artery, is a sufficient indication not to apply the compression at this part, because it will act not only on the artery but also on the nerve, and give rise to acute pain, which will necessitate its suspension. The same inconvenience does not occur in the upper part of the region, and the two organs may be compressed separately. It is the same with respect to the lower part of the region. At these two points it is sufficient to examine the relative position of the nerve and the artery, in order to see that the compression at the upper part should be directed somewhat more backwards, while below it is more advantageous to give it an anterior direction, that is to say, more towards the inner edge of the biceps.

If the application of a ligature to the middle portion of the artery presents no difficulty and offers in general the greatest prospect of cure, we must, however, explain why success does not always attend an operation apparently so simple. This depends upon three circumstances, the premature bifurcation of the brachial artery, the unusual size of the inferior profunda artery, and the number of branches furnished by the brachial artery during its course. Nothing is more common than to find the brachial artery bifurcating at all heights even in the hollow of the axilla, the two branches being of equal or of unequal size. What, then, happens if we ligature the brachial artery? Following the rules that are laid down we arrive at an arterial trunk and apply a ligature, but either because of the anastomoses, or because the artery ligatured is not the one which gives rise to the loss of blood, the hæmorrhage is not arrested. Warned by such a case, the surgeon should always satisfy himself that there is not a second trunk in the sheath, and if after the first ligature has been applied blood continues to flow, he must not hesitate to tie this accessory or sometimes principal vessel.

The second cause of the continuance of the hæmorrhage, or rather of the insufficiency of ligaturing only one artery when it relates to an aneurism in the bend of the elbow, depends upon the existence of a kind of collateral artery, which detaches itself from the brachial and sometimes from the axillary, emerges from the sheath of the nerves and vessels, passes along the inner border of the brachialis anticus muscle, and having furnished some branches to this muscle joins the brachial artery a little above its division into the radial and ulnar arteries. If in this case the brachial artery is tied at its centre, the course of the blood will not be arrested, and the aneurism will continue to pulsate. This condition may be ascertained by compressing the brachial artery. But I do not think that the surgeon will be justified in searching for the collateral artery for the purpose of applying a ligature. Here then we have a serious impediment to success, and one which sometimes compels the surgeon to relinquish a simple and often efficacious method of treatment, for others of a more radical kind, such, for instance, as opening the sac when it is an aneurism, and ligaturing both ends of the artery when the vessel is wounded.

Lastly, there is a third cause which unites with the preceding, but which only acts in cases of secondary hæmorrhage. The number of muscular branches furnished by the brachial throughout its entire course renders the formation of a clot in the two extremities of the artery difficult, and the anastomoses of the recurrent radial and ulnar arteries may convey by the lower end as much blood as arrives from the upper end, there is here as much fear of hæmorrhage from the lower end as from the upper. This source of danger is nowhere so great as in this region.

After having spoken so fully concerning the brachial artery, it only remains for us to describe the manner in which it is tied. A ligature may be applied to this vessel in any part of its course. In the dissecting room it is customary to perform the operation at three different points in the course of the artery: at the upper, middle and lower part of the region.

At the upper part, opposite No. 1, the brachial artery is easily tied, more so than in the axilla. The incision of the skin should be made in the direction of an imaginary line passing from the union of the anterior with the posterior, two thirds of the axilla to the middle of the bend of the elbow passing along the internal surface of the arm. This incision does not involve any important organ; when the brachial aponeurosis is reached it is divided by a succession of scratches, and the inner edge of the coraco-brachialis sought for, which is here in immediate connexion with the artery. The ligature may be passed either inwards or outwards as the artery is accompanied by two veins of equal size.

At the middle part the ligaturing of the brachial artery presents no difficulty if we seek for the inner edge of the biceps muscle. The muscle is seen through its aponeurosis, the latter is divided and the muscle exposed, an assistant by means of a blunt hook carries it little outwards. The sheath of the vessels and nerves is then brought in sight, and is opened as before. If the nerve is in front of the artery, it must be put aside and the ligature applied. If the nerve is behind the artery, care must be taken not to include it in the ligature, for the two are in direct contact with each other.

In the lower part of the region the application of a ligature is still very easy, because the artery is more superficial and less covered by the inner edge of the biceps. At this part, the median nerve is completely on the inner side of the vessel and the only guide is the inner edge of the biceps, it is necessary to pass somewhat to the inside of the muscle. The opening of the sheath of the artery presents no danger. In applying the ligature we must avoid wounding either of the two veins which accompany it.

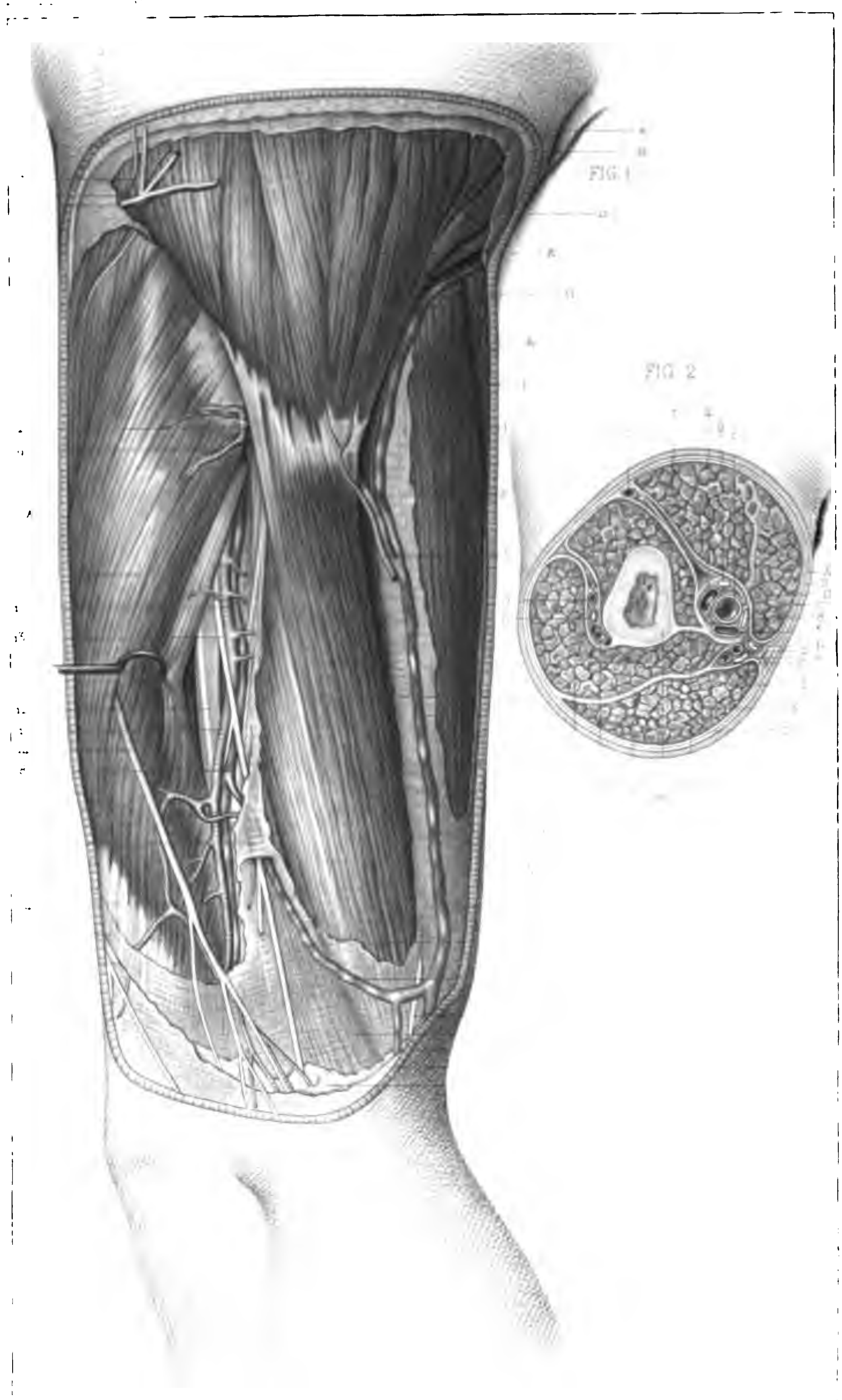

FIG. 1

FIG. 2

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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXVI.

Figure 1.—Humeral or Brachial Region.

External surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C Section of the deep layer of the superficial fascia.
D. Brachial aponeurosis covering the deltoid muscle.
E. Humeral aponeurosis covering the biceps muscle.
F. Humeral aponeurosis covering the triceps muscle.
G. Humeral aponeurosis covering the brachialis anticus muscle.
H. Process of the humeral aponeurosis forming a fibrous arch which gives passage to the vessels and nerves.
I. Short portion of the biceps.
I′. Long portion of the biceps.
J. External portion of the triceps muscle.
K. Inferior portion of the deltoid passing into its tendon of insertion into the humerus and becoming continuous with some of the fibres of the brachialis anticus muscle.
L. Body of the brachialis anticus muscle.

1. External collateral branch of the brachial artery.
2. Superficial branch furnished by the superior profunda artery.
3. Superficial branches of the circumflex artery.
4. Branch forming an anastomosis between the superior profunda artery and the anterior recurrent radial.
5. Superficial artery coming from the brachial and distributed to the lower portion of the deltoid.
6. Cephalic vein.
7. Anastomosis of the cephalic vein with the external collateral vein.
8. Trunk of the external collateral vein.
9. Venous branch emerging from the triceps muscle and joining the external collateral vein.
10. Venous branch joining the circumflex vein.
11. Cephalic vein in the grove which separates the biceps from the deltoid muscle.
12. Trunk of the radial nerve. (Musculo-spiral).
13. Superficial and cutaneous branch of the musculo-spiral nerve.
14. Second superficial or cutaneous branch of the musculo-spiral nerve.
15. Superficial or cutaneous branch of the circumflex nerve.
16. Superficial or cutaneous branch of the musculo-cutaneous nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY

The external surface of the region of the arm affords fewer applications to pathology and operative surgery than the internal surface Lesions of this region are, nevertheless, of frequent occurrence, because in falls and external injuries it is on this part, which is the most exposed, that the injury produces its effects. If the wound is superficial, it presents no special peculiarity, but that is not the case if the wound is deep and situated at the inferior third and middle part of the region, because then the external collateral artery and the musculo-spiral nerve may be wounded. Wounds of the external collateral artery are not dangerous, as the vessel is small, and more particularly because the flow of blood is easily arrested by compressing the artery against the humerus.

The vital lesions (*lésions vitales*) present nothing peculiar, and therefore call for no remarks. We will merely observe, that the musculo-spiral nerve, by passing along the groove to which it gives its name, by its close proximity to the bone around which it turns by its situation beneath the skin, and lastly by a kind of special predisposition often becomes affected in local diseases and in general diseases; it is in this way, for instance, that we meet with various degrees of paralysis of this nerve after external injuries, or from lead poisoning. This condition is to a certain extent compensated for by the facility with which the nerve may be electrified as it passes out of the groove on the posterior surface of the humerus.

The organic diseases of the region almost always commence in the humerus, which may be affected with caries, necrosis, cancer or cysts. Cysts of the humerus are not uncommon; Dupuytren had turned his attention to them. While acting as prosector at Clamart, we met with a humerus enclosing a cyst the size of a hen's egg. The parieties of the bone were so thinned that the slightest effort was sufficient to fracture it.

The humeral region includes within its boundaries the whole of the body of the humerus. The body may be fractured at any part of its entire length. These fractures may be transverse, oblique, simple or compound, and may be produced by the *contre coup* when the cause acts on the two extremities of the bone, or, as is more usually the case, they may be direct, that is to say, depend upon a force acting immediately on the part affected. Muscular contraction alone may produce a fracture of the humerus. We have ourselves attended a student, who, in amusing himself with a companion in endeavouring to force down the fore-arm on to a table, offered such resistance that the humerus was fractured by the force of the muscles.

An examination of the muscles of the region explains the cause of the displacement of the fractured portions of the humerus. Thus, when the fracture is transverse and situated at the centre of the body, below the insertion of the deltoid, there will be only a slight displacement, because the brachialis anticus and triceps muscles, as well as the internal and external intermuscular aponeuroses maintain the fragments in apposition.

When the fracture is above the insertion of the deltoid, the lower portion drawn upwards and outwards by the deltoid overlaps the outer side of the upper fragment which is drawn downwards and inwards by the latissimus dorsi and pectoralis major muscles. If the fracture is at the lower part of the bone, there is not much displacement because the triceps and brachialis anticus muscle retain the fragments in contact

When the fracture is oblique, which is mostly the case, the displacement will be greater. In this case the lower portion is always carried upwards by the muscles, and the overlapping is in proportion to their power. There is scarcely any bone more liable to imperfect union than the humerus.

FIGURE 2.—**Section through the centre of the Arm.**

EXPLANATION.

A. Section of the skin.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Section of the superficial aponeurosis of the arm continued over the whole circumference of the limb, and sending in septa from the deep surface forming sheaths for the muscles, vessels and nerves.
D. Section of the biceps muscle separated by a fibrous septum from the brachialis anticus muscle, which is situated outside the biceps and surrounds more than half the circumference of the humerus.
E. Portion of the brachial aponeurosis covering the innermost portion of the triceps muscle.
F. Section of the internal portion of the triceps muscle.
G. Portion of the brachial aponeurosis still covering the triceps muscle.
H. Fibrous septum which separates the internal from the external portion of the triceps.
I. Section of the external portion and of the long portion of the triceps. It is seen that these two portions are not separated by a fibrous septum.
J. Section of the cephalic vein.
K. Section of the humerus.
L. Fibrous septum separating the brachialis anticus and triceps muscles.

1. Section of the brachial artery.
2. Section of the inferior profunda artery.
3. Section of the superior profunda artery.
4, 5. Section of the two brachial veins.
6. Section of the superior profunda vein.
7. Section of the inferior profunda vein.
8. Section of the median nerve.
9. Section of the musculo cutaneous nerve.
10. Section of the ulnar nerve.
11. Section of the internal cutaneous nerve.
12. Section of the musculo-spiral nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Figure 2 is given for the purpose of explaining the relation of the vessels and nerves after amputations at the middle part of the arm. The Figure shows that after amputation of the arm the surgeon should ligature three arteries, the brachial, the superior profunda, and the inferior profunda. It is unnecessary to say that on account of its size the brachial should be tied first. It is found at the inner part of the region separated from the section of the humerus by the thickness of the brachialis anticus muscle. When this vessel has been tied, the surgeon proceeds to ligature the superior profunda artery which is close to it, a little more to the inner and back part of the stump. With regard to the inferior profunda it is seen to be situated on the outer side, close to the humerus.

FIG. 1

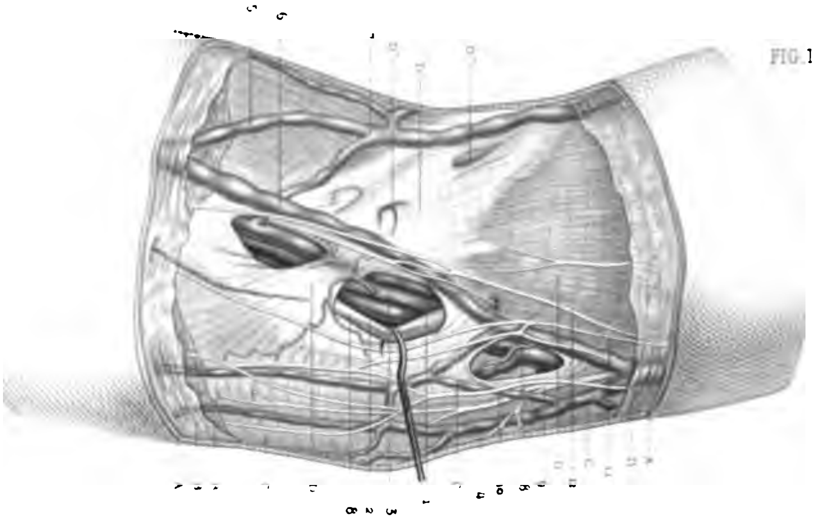

FIG. 2

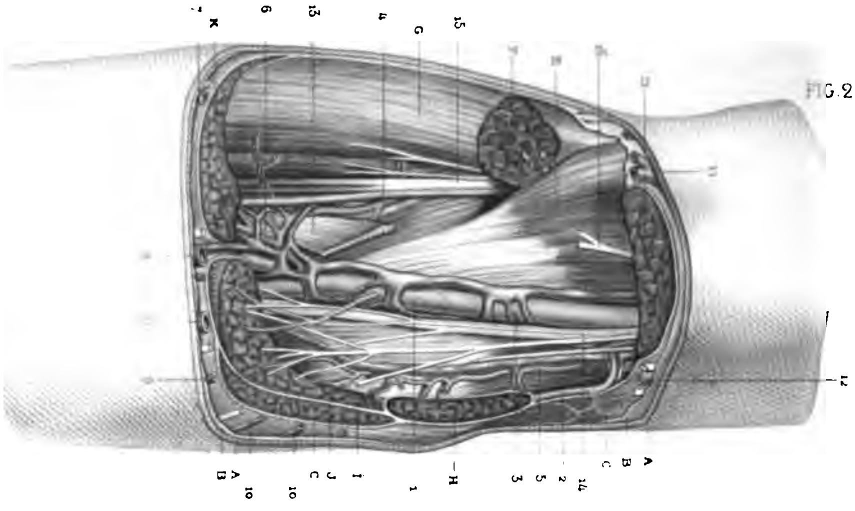

FIG. 3

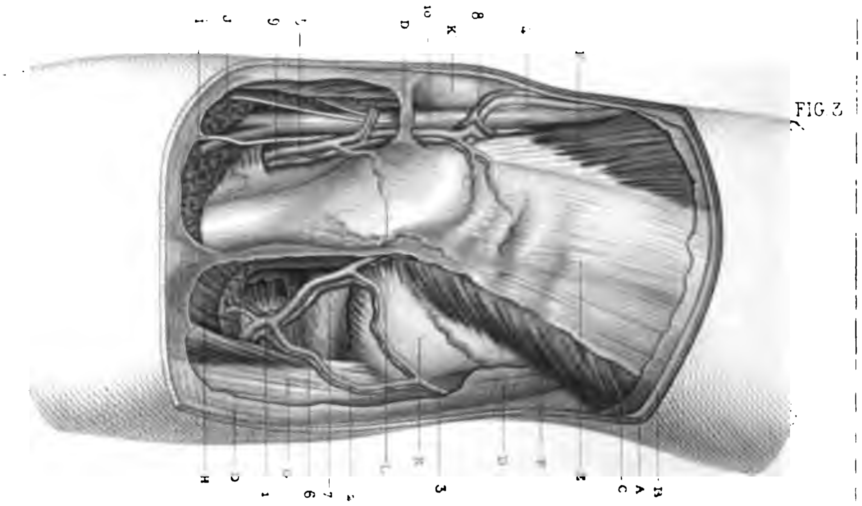

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PLATE LXXVII.

Figure 1.—Region of the Elbow.

Anterior surface. Superficial layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Superficial layer of the superficial fascia covering the superficial veins of the bend of the elbow.
B′. Deep layer of the superficial fascia passing below the superficial veins of the bend of the elbow.
C. Brachial aponeurosis continued in the region of the bend of the elbow and into the inferior part of the same region to form lower down the antibrachial aponeurosis.
D. Aponeurosis of the biceps muscle joining below the tendon and aponeurotic expansion of the same muscle.
D′. Tendon of the biceps furnishing a fibrous expansion which is continued over the aponeurosis covering the external muscles of the fore-arm.
D″. Aponeurotic expansion of the biceps laid open to show the vessels and nerves of the bend of the elbow.
D‴. Openings or aponeurotic arches of the external expansion of the biceps forming passages for the vessels and nerves.

1. Brachial artery at the bend of the elbow with its relations to the veins and median nerve.
2, 3. Brachial veins accompanying the artery of the same name.
4. Basilic vein.
5. Cephalic vein.
6. Median vein.
7. Termination of the median cephalic vein in the cephalic vein.
8. Median nerve.
8′. Cutaneous filaments of the musculo-cutaneous nerve.
9. Cutaneous filaments of the internal cutaneous brachial nerve.
10. Another superficial terminal filament of the internal cutaneous brachial nerve.
11, 12. Terminal filaments of the musculo cutaneous nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Figure has been given to guide the surgeon in the operation of bleeding. We cannot urge the student too strongly to examine this Figure before making use of the lancet. We see, in fact, that five large veins may be opened at the bend of the elbow. These veins are: the median basilic, the median cephalic, the median, the cephalic, and the basilic. The median basilic is here so related to the artery that the latter is liable to be wounded, unless we take the precaution to avoid the artery by a skilful manœuvre, which consists in either pressing the vein to one side or opening it by a horizontal incision. With regard to the nerves, it may be seen that the musculo-cutaneous nerve and the internal brachial accompany all the superficial veins, so that it is useless to select such or such a vein in the hope to avoid wounding these nerves. The best performed bleeding cannot entirely avoid this accident. It is, however, easy to satisfy oneself that the external veins have fewer nerves accompanying them, so that in this respect it is preferable to bleed from the cephalic or median cephalic veins.

In every case, we may be satisfied that the veins are contained between the two layers of the superficial fascia, and that they are separated from the skin by the superficial layer. In fat persons the veins are not very apparent, while in thin persons they are very prominent. In the first case the incision is not easily made; in the second it is; but then on the other hand the vein easily escapes.

Figure 2.—Region of the Elbow.

Anterior surface. Deep layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Superficial aponeurosis of the region of the elbow.
D. Section of the biceps muscle.
E. Brachialis anticus muscle.
F. The supinator longus muscle.
G. The radial muscles.
H. Section of the pronator radii teres.
I. Section of the flexor sublimis digitorum.
J. Section of the flexor profundus digitorum.
K. Section of the supinator longus at the lower part of the region.

1. Brachial artery.
2. Inferior profunda artery.
3. Anastomotic branch between the inferior profunda artery and the anterior ulnar recurrent.
4. Anastomosis of the anterior recurrent radial artery with the superior profunda coming from the brachial.
5. Brachial veins anastomosing with each other by transverse branches which pass in front of the brachial artery.

7. Cephalic vein.
8. Median vein.
9. Basilic veins.
10. Afferent branches of the basilic vein.
11. Cephalic veins.
12. Basilic vein.
13. Section of the tendon of the biceps muscle.
14. Muscular branches of the median nerve.
15. Muscular branches of the radial nerve.
16. Cutaneous branches of the musculo-cutaneous nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In this Figure is represented all that is necessary to explain the various kinds of aneurisms which may occur in the region after wounds of the brachial artery and at the bend of the elbow from the operation of bleeding. Remembering the veins which accompany the artery, we can readily understand that an arterio-venous aneurism may be easily formed. Moreover, an arterio-venous aneurism may form between the brachial artery and the median basilic vein, notwithstanding the presence of the aponeurotic expansion of the biceps. We may also assure ourselves that the brachial artery passes immediately in front of the articulation of the elbow without forming any curve which easily allows it to follow the movements of extension and flexion of the fore-arm. From this arrangement two things follow; the first is, that in forcible extension, in dislocation of the elbow backwards, and in transverse fracture of the lower end of the humerus, it is not uncommon to meet with laceration of the brachial artery. The laceration being followed by complete absence of the radial pulse, after having determined the existence of this lesion, it will be necessary to amputate the fore-arm. The second is the possibility of arresting the circulation in the radial and ulnar arteries by forcibly flexing the fore-arm on the arm. This mode of compression has been employed in wounds of the radial and ulnar arteries, and in cases of aneurism of these vessels.

Figure 3.—Region of the Elbow.

Posterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Section of the posterior and superficial aponeurosis of the elbow.
D. Section of the posterior and superficial aponeurosis continuous with the superficial aponeurosis of the anterior surface of the region.
D′. Aponeurotic arch formed by the posterior aponeurosis of the elbow.
E. Tendon of insertion of the triceps into the olecranon.
F. External portion of the triceps muscle.
F′. Internal portion of the triceps muscle.
G. Extensor carpi ulnaris muscle.
H. Section of the anconeus muscle.
I, J. Section of the extensor communis digitorum.
K. Condyle of the humerus.
K′. Internal condyle of the humerus.
L. Olecranon.

1. Posterior recurrent radial artery.
2. Anastomosis of the posterior recurrent radial artery with the profunda superior.
3. Branch of the profunda superior.
4. Branch of the profunda inferior.
5. Posterior ulnar recurrent.
6, 7. Posterior radial recurrent veins.
8, 9. Posterior ulnar recurrent veins.
10. Ulnar nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

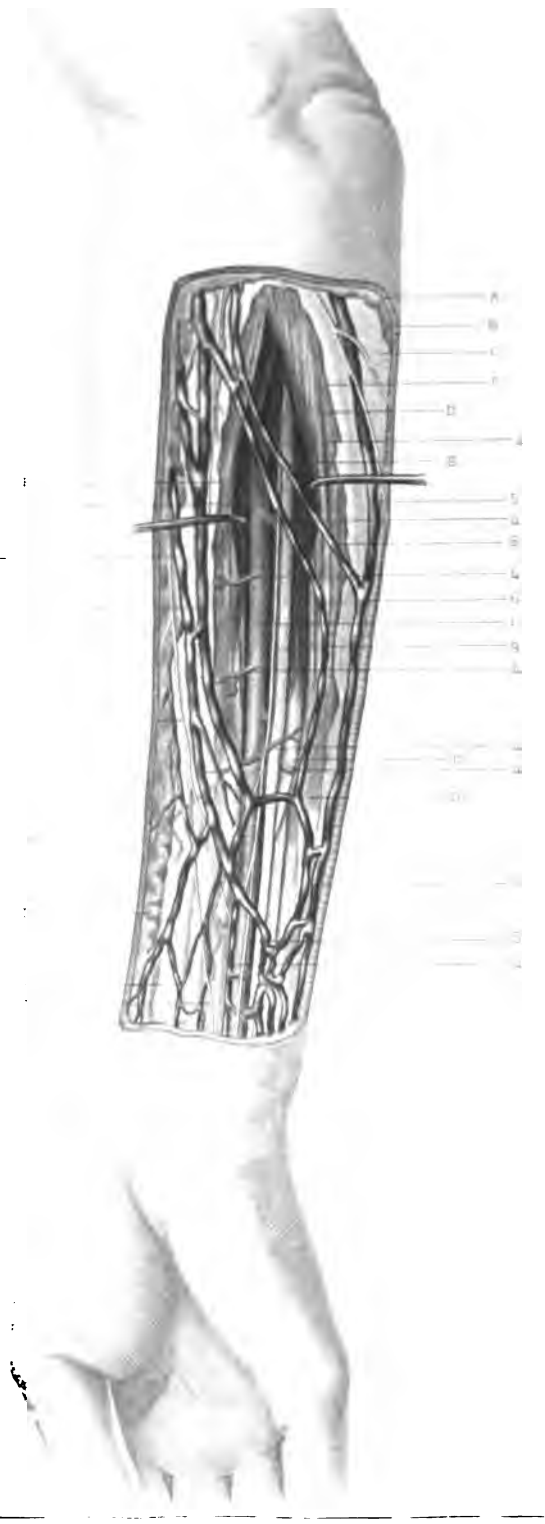
The osseous projections which occur on both sides of the articulation of the elbow-joint account for the frequent fractures of the inferior extremity of the humerus. These fractures are sometimes superficial and sometimes deep. In the first case they are not so important, and consist, so to speak, of a kind of separation of the epiphyses (condyle or trochlea), or a kind of laceration of the osseous surfaces into which considerable masses of muscles are inserted. In this case the displacement is slight, because the muscles and their aponeuroses retain the fractured surfaces almost in direct contact. There are, however, exceptions in which there is a considerable amount of separation. We have ourselves seen a case of fracture of the internal condyle followed by such an amount of displacement that the fractured portion perforated the skin in the middle part of the bend of the elbow. What was strange was that after having pursued this course during which it lacerated the median basilic vein, the fragment was situated close to the internal part of the elbow. It might be objected that the skin having become displaced was torn over this osseous projection. I do not think this was the case, as it is difficult to understand how the skin belonging to the bend of the elbow could by any gliding movement cover the internal condyle of the humerus. When the fracture is deeper, it necessarily opens the articulation of the elbow. In this case the fracture sometimes occupies the external side, sometimes the internal cavity of the articulation; occasionally there is at the same time a transverse fracture. What renders these fractures dangerous is that the fragment being drawn sometimes upwards and sometimes downwards, continues to be moveable, and the irregular formed callus which ensues necessarily extends to the articular surfaces. From this follows anchylosis, which must be treated as much as possible by the early application of passive movements.

From the study of the relations of the three osseous projections of the elbow, viz., the external condyle, the internal condyle, and the olecranon, we may obtain an excellent guide for diagnosing fractures of the lower extremity of the humerus, and dislocation backwards of the two bones of the fore-arm. When there is a dislocation, the olecranon is carried behind the humerus and more or less upwards, and of the three projections just mentioned, which in the normal state are on the same horizontal line, the condyles of the humerus will be below the level of the olecranon. When there is a fracture of the humerus at its lower extremity, the relations of the three projections are not changed.

In regard to fractures of the olecranon, we have only to observe that this process forms a projection which is more prominent when the fore-arm is bent upon the arm, and that then it is more easily fractured. We will add that this process presents a beak, lower down a neck, and lower still a base, hence the natural division of these fractures into three varieties.

The number of articular surfaces readily explains the numerous varieties of dislocations of the elbow-joint admitted by authors who have made a special study of it.

Chronic diseases of the elbow joint often require the resection of the entire articulation, or of a part of it. The operation must be performed from the posterior surface of the joint. Of the various plans which have been suggested, that of M. Nélaton is the most certain and the most easy. In fact, by making an incision on the external side of the articulation, the whole of the joint is immediately exposed, and the radius and the ulna may be speedily resected. The section of the humerus requires some precautions as regards the ulnar nerve, which is liberated from its sheath and carried to the inner side by an assistant by means of a blunt hook. Throughout the operation there is no danger of wounding the brachial artery, because it is protected by the brachialis anticus muscle.



LIBRAIRIE GERMER BAILLIERE

PLATE LXXVIII.

Internal Region of the Fore-Arm or Cubital Region.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Aponeurosis of the fore-arm in the cubital region.
C′. Section of the aponeurosis of the fore-arm giving insertion to the muscles of the fore-arm.
D. Flexor carpi ulnaris muscle accompanying the ulnar artery.
D′. Tendon of the flexor carpi ulnaris muscle.
E. Flexor profundis digitorum muscle.
E′. Tendon of the flexor profundis digitorum muscle.
F. Superficial flexor muscle of the fingers.
F′. Tendon of the superficial flexor muscle of the fingers.
G. Tendon of the palmaris longus muscle.

1. Ulnar artery (Part where ligaturing the artery is performed in the middle of the fore-arm).
2. Ulnar artery where it is deeper seated. (Place where a ligature is applied to this artery at the superior part of the region).
3. Ulnar artery in the lower part of the region. (Place where a ligature is applied at the inferior third of the fore-arm).
4. Muscular branches supplied by the ulnar artery.
5. Superficial ulnar veins going to form the basilic vein.
6. Anastomoses of the ulnar veins with the median veins.
7, 8. Median veins.
9. Ulnar vein.
10. Terminal branch of the musculo-cutaneous nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate is intended to supply the anatomical knowledge necessary for placing a ligature on the ulnar artery, whose relations with the muscles, nerves, and other organs have been accurately preserved. To obtain the direction of this artery, the surgeon should draw a line from the inner condyle of the humerus to the outer side of the pisiform bone. This direction may also be indicated by an irregular line commencing at the middle of the bend of the elbow and passing to the union of the superior with the two inferior thirds of the inner side of the fore-arm, and from this point passing in the direction of the line previously mentioned. This line corresponds the most accurately of the two to the course of the artery, and includes that portion of the vessel which passes obliquely from the bend of the elbow to the inner side of the fore-arm. It is usual in works on operative surgery to lay down the rules for ligaturing the artery in three different parts of its course. We shall, therefore, give the rules which should guide the surgeon in applying a ligature to it at the upper, middle, and lower part of the fore-arm.

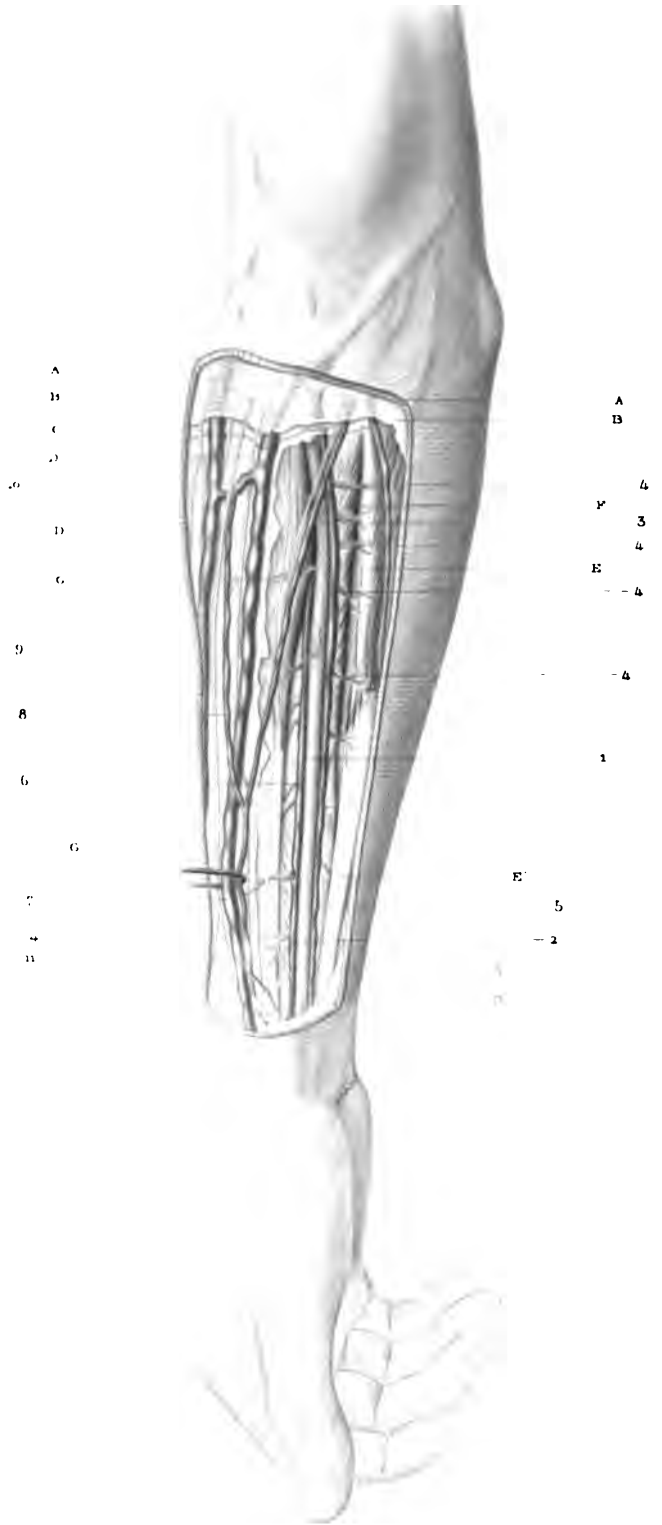
High up near its origin, the ulnar artery presents the same anatomical relations as the brachial artery, so that in applying a ligature the same course is to be pursued as in tying the brachial artery itself.

The drawing exhibits the anatomical indications which are indispensable for tying the ulnar artery in the middle of the fore-arm. It is seen that the ulnar artery rests upon the flexor profundus digitorum, while it is covered by the flexor carpi ulnaris and the flexor sublimis digitorum. It is also seen that the ulnar nerve is placed on its inner side. Moreover, the artery is bound down by the deep aponeurosis of the fore-arm, that is to say, by the aponeurotic layer which separates the deep flexor from the layer of superficial muscles. Having obtained this anatomical knowledge, it is easy to ligature the artery, which in consequence of its deep position might otherwise escape the investigation of the surgeon. The following are the rules for this operation. Following the line we have traced, an incision is made through the skin and cellular tissue from six to seven centimetres (2·36 to 3·45 English inch) in length. We thus reach the investing aponeurosis, which gives insertion to the flexor ulnaris and to the superficial flexor. The first intermuscular space is sought for, which is recognised by a yellow line; but if it is not found, the skin is drawn to the inner edge of the ulna, and we again examine the anterior surface of the aponeurosis surrounding the limb where the space is soon found. An incision is made directly over this space, the muscles are separated, and beneath them is seen the deep aponeurosis. This is carefully divided, and we come upon the ulnar nerve; the artery is on the outer side of the nerve. It is not uncommon to meet with an irregularity where the artery is more superficial, being placed beneath the superficial aponeurosis along the external border of the flexor ulnaris; sometimes it is even met with beneath the skin. Knowing this, the surgeon will not be taken by surprise, and should he not meet with the vessel in its usual position, he will not hesitate to look for it beneath the skin, or the superficial aponeurosis.

Towards the inferior third, the ulnar artery rests on the flexor profundus, and is covered by the deep aponeurosis of the fore-arm, which is now much reduced in thickness; lower down it is placed beneath the tendon of the flexor ulnaris, covered by the superficial aponeurosis and the skin. M. Malgaigne has shown that by turning the hand backwards, we raise up the deep layer of muscles, so that in many persons the ulnar artery may be seen pulsating beneath the skin, and nothing would be easier than to pass a needle beneath it. This position, therefore, furnishes us with a useful resource when we wish to tie the vessel. But the most essential guiding point is the tendon of the flexor ulnaris.

The following is the method of applying this ligature: an incision is made five to six centimetres (1.18 to 2·36 English inch) in length, terminating from two to three centimetres (·78 to 1·18 English inch) above the bend of the wrist; we thus reach the superficial aponeurosis or envelope which is laid open to the extent of the incision. We thus expose the first guiding point, which is the tendon of the flexor ulnaris. The deep aponeurosis which covers the ulnar artery and nerve is opened on the outer side of this tendon. The ligature is applied by passing from within outwards so as to avoid wounding the nerve.

Mechanical injuries, such as wounds, contusions and fractures, are not uncommon, and this is easily explained by the position we assume in defending ourselves when attacked, or in the case of a fall. Thus, wounds of the ulnar artery often occur in surgical practice. Within six months, during which I have been attached to the Hôpital Saint Antoine, and where the cabinet-makers of the district come, I have met with three wounds of the artery from edged tools; in a recent case the ulnar nerve was also divided.



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LIBRAIRIE GERMER BAILLIERE

PLATE LXXIX.

External or Radial Region of the Fore-arm.

EXPLANATION.

A. Section of the skin bounding the region.
B. Superficial layer of the superficial fascia.
C. Deep layer of the superficial fascia.
D. Aponeurosis of the fore-arm.
D′. Section of the aponeurosis of the fore-arm.
E. Flexor carpi radialis muscle.
E′. Tendon of the flexor carpi radialis muscle.
F. Pronator radii teres muscle.
G. Supinator radii longus muscle.
G′. Tendon of the supinator longus muscle.

1. Radial artery at its middle part.
2. Radial artery towards its inferior part.
3. Radial artery towards its superior part.
4. Muscular branches furnished by the radial.
5. Internal radial vein.
6. External radial vein.
7. Superficial radial veins.
8. Anastomosis between the superficial radial veins.
9. Branch of the radial veins.
10. Terminal branches of the musculo-cutaneous nerve.
11. Radial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In order to trace the course of the radial artery, a line should be drawn commencing at the middle of the bend of the elbow, and passing downwards and outwards to the middle of the space which separates the styloid process of the radius from the tendon of the palmaris longus. The artery may be tied at two points within the limits of the region with which we are now occupied. The application of a ligature at its origin requires the same knowledge and is guided by the same principles as those for ligaturing the brachial artery; it is, therefore, unnecessary to describe the operation.

At the upper or towards the middle-part of the artery, the following are its anatomical relations. The artery is seen situated in an intermuscular space, bounded externally by the supinator radii longus and internally by the pronator radii teres, above and lower down by the palmaris longus. It is covered by the inner edge of the supinator longus which accompanies it. The radial nerve is situated more to the outer side of the axis of the limb. The following are the structures met with in passing down to the artery. After the skin comes the subcutaneous cellular tissue, and here there is some risk that the median vein may be beneath the knife; should this be the case, the vein must be carefully removed to one side of the incision so as to avoid its being wounded. The next incision divides the aponeurosis and the internal border of the supinator longus is brought into view. The internal border of the muscle is raised up, and we thus reach the deep aponeurosis which covers the vessels. The aponeurosis is carefully divided, and the ligature applied to the artery, passing it either from the right or left side indifferently since the radial nerve is placed at a sufficient distance from the artery.

At the inferior third of the region the radial artery becomes so superficial that it may be felt, and it is there that the condition of the pulse is always determined. In fact, it is only covered by the skin and the superficial aponeurosis of the region. It is accompanied, as seen in the Plate, by two veins, while the radial nerve is placed at some distance towards its outer side. In order to apply a ligature in the direction of the line we have traced, an incision is made five centimetres (1·96 English inch) in length, commencing three centimetres (1·19 English inch) above the bend of the wrist, or better to the extent we have represented. After dividing the skin A, and the fatty cellular tissue, we come to the superficial aponeurosis beneath which the vessel is placed and whose transparency sometimes allows the artery to be seen before it is divided. The aponeurosis is divided to the same extent as the external wound, and we then reach the artery which must be ligatured from without inwards, or in the contrary direction at the discretion of the operator.

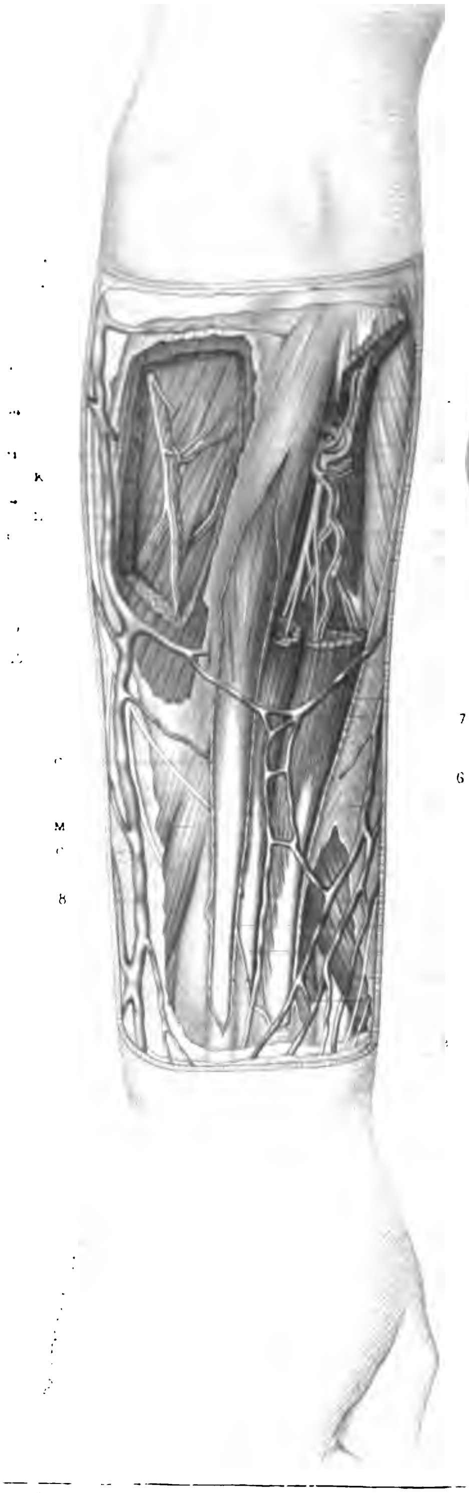
In our remarks, we have entered directly upon the most important subject connected with this Plate, but it is also necessary to say something upon the surgical applications relating to the physical or vital lesions of the region.

In regard to the physical lesions, we may observe that beneath the skin of this region there are numerous veins and lymphatic vessels. The veins are here very numerous and very large, presenting a free anastomosis both with the superficial and the deep veins. Their size is sufficient to allow of bleeding from them when it cannot be done at the bend of the arm. In every case if they are opened, they will give rise to a free discharge of blood. They constitute the superficial radial veins, and after receiving a branch of the median vein form the cephalic from which we may also bleed. It is unnecessary to say that in the case of a wound of one or of several of these veins, we must remove the clothes because the compression they produce upon the limb is sometimes sufficient to keep up the hæmorrhage.

The lymphatic vessels of the region are numerous, and their inflammation occurs as frequently as a complication of wounds of the hand or of the present region as inflammation of the veins, erysipelas or phlegmon.

Other organs may be involved in wounds of the fore-arm: these are the muscles and nerves. The muscles which we find here are the supinator longus, the extensor carpi radialis longior and brevior, the pronator teres, and the flexor carpi radialis; the absence of those movements over which these muscles preside would sufficiently indicate that they were wounded. If the radial nerve is involved, sensibility and motion are destroyed throughout the parts to which the ramifications of the nerve are distributed below the seat of injury. We cannot, therefore, too strongly recommend that the sensibility and power of motion of the parts should be carefully examined after injuries not only of the fore-arm but also of all other regions, in order that we may be able to form a correct prognosis. Nothing is easier than this, if we bear in mind the distribution of the nerves to which we have referred.

This is the proper occasion on which to speak of fractures of the fore-arm and to explain the information afforded us by the present, the previous and the succeeding Plate. The two bones of the fore-arm are seen to be separated by a space filled up by a fibrous layer termed the *interosseous ligament* This ligament offers an impediment to the separation of the two bones but does not prevent their being brought towards the axis of the fore-arm. Thus, if the bones, which are maintained apart by their superior and inferior articulations, are fractured towards their centre, for instance, the four ends of the bones will converge towards the axis of the fore-arm and fill up the interosseous space. To allow the bones to become consolidated in this position would be to permit the formation of a callus that would unite them into a single bone, and this would consequently condemn the person to loose the movements of pronation and supination, which are only possible, on the condition that the axes of the two bones of the fore-arm shall be independent of each other. It is, therefore, absolutely necessary that in the treatment of these fractures one primary condition should be fulfilled, namely, that the ends of the bones should be removed from the centre of the arm, so that each bone shall unite separately. This result is to be obtained by replacing the soft structures and the muscles, especially in the interosseous space, by means of graduated compresses placed on the anterior and posterior surfaces of the fore-arm. Here, however, we must point out a danger common indeed to every apparatus applied to the fore-arm, namely, the occurrence of gangrene, which is liable to follow their application. This accident, which shows itself by the formation of black spots on the fingers accompanied by effusion of serum, arises from the obliteration of the radial and ulnar arteries, in consequence of their being compressed against the radius and the ulna. To avoid this accident, the pressure must be moderated so that the circulation is not arrested. This may be ascertained by feeling the pulse on the radial artery.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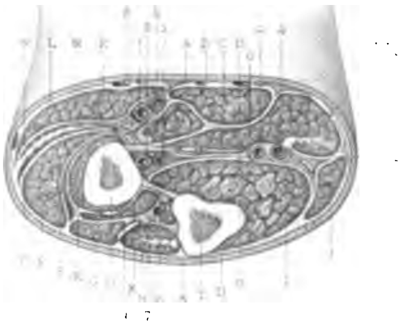
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PLATE LXXX.

FIGURE 1.—Region of the Fore-arm.

Posterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Superficial fascia and subcutaneous cellular tissue.
C. Superficial aponeurosis of the fore-arm.
C′. Section of the aponeurotic sheath of the extensor minimi digiti.
D. Extensor communis digitorum.
D′. Section of the extensor communis digitorum towards its superior insertions.
D″. Principal tendon of the extensor communis digitorum passing into its aponeurotic sheath.
E. Extensor carpi radialis longior.
F. Extensor carpi radialis brevior.
G. Abductor pollicis, and more internally the extensor primi internodii pollicis.
H. The same muscle seen a little lower down.
I. Internal fibres of the extensor communis digitorum.
I′. Tendon of the internal fibres of the extensor communis digitorum.
J. Body of the extensor minimi digiti muscle.
J′. Tendon of the same muscle in its aponeurotic sheath which is laid open.
K. Section of the extensor carpi ulnaris muscle.
L. Deep fibres of the same muscle.
M. The most inferior fibres of the extensor carpi ulnaris muscle still covered by their aponeurotic sheath.

1, 3. Posterior recurrent radial artery distributed to the muscles of the posterior radial region.
2. Ascending branch of the recurrent radial artery.
4. Recurrent branch of the posterior ulnar artery.
5. Deep branch of the recurrent ulnar artery.
6. Afferent veins of the superficial radial vein.
7. Anastomosis between the veins forming the superficial radial and ulnar veins.
8. Afferent vein of the superficial ulnar.
9. Point of junction between the superficial and deep anastomoses of the posterior veins of the fore-arm.
10. Trunk of the posterior afferent veins of the superficial ulnar.
11. Posterior recurrent ulnar vein.
12. Posterior recurrent radial vein.
13. Branch of the radial nerve distributed to the extensor muscles of the fingers.
14. Branch of the ulnar nerve distributed to the extensor carpi ulnaris.
15. Internal and terminal branch of the internal cutaneous branch of the brachial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The mechanical lesions of this region are seldom attended with much risk, because there are here no vessels or nerves which can endanger life. Thus, the superficial wounds and contusions cannot be dangerous as they only reach the subcutaneous veins, and their size is insufficient to give rise to any serious hæmorrhage. If the injury extends beyond the aponeurosis it will affect muscles whose office is to perform certain movements, but which, if necessary, may be accomplished by others. The deep-seated nerves which may be wounded are the branches of the radial nerve which supplies all the extensors of the fore-arm. The posterior interosseous artery, a branch of the ulnar and sometimes of the radial, is too deeply situated and too well protected by the muscles and the aponeuroses that we should fear its being wounded. Nevertheless, if this should happen, it is impossible to seek for the vessel; in our opinion, in these cases it is preferable to make use of plugs moistened with the perchloride of iron, or to compress the brachial artery. If these means fail, the brachial artery must be tied at the bend of the elbow. The inflammations which may attack the posterior region of the fore-arm are not always very severe, they, nevertheless, present certain peculiarities which it is necessary to point out. Thus, phlegmonous subcutaneous inflammations are not uncommon; sometimes they belong to the part and at other times they originate elsewhere. Those which are primary may be developed spontaneously, or in consequence of wounds, or of contusions, they present nothing peculiar. Those which are derived from some neighbouring part, come sometimes from the region of the olecranon or of the palm of the hand. Thus, nothing is more common than to see a wound or a contusion of the serous bursa covering the posterior surface of the olecranon become the source of a phlegmonous inflammation which rapidly extends to the posterior surface of the fore-arm.

When the inflammations are beneath the aponeuroses, they are very dangerous, because they are multiplied. In fact, in this region we find two layers of muscles, and each of them, so to speak, is contained in an aponeurotic sheath, as may be seen in the present Plate. Inflammation occurring in the midst of these organs is confined within each sheath, which presenting differences as to its extent and vascularity also presents a separate process of inflammation and suppuration which is altogether independent of that occurring in the neighbouring sheath. Hence, abscesses may arise in several of the sheaths, may occur at different depths, and may be developed at different periods of time. Where is the surgeon who is sufficiently skilful to follow the development of each of these inflammations so as to open them at the most appropriate time, and who would venture to say that he could open them all by a simple incision, as he might do in a case of inflammation of the anterior part of the fore-arm?

At the lower part of the region, the extensor muscles of the fingers are lodged in fibrous sheaths, which increase in strength as we approach the wrist. Nearly all the tendons present in addition a synovial covering which is often the seat of a disease to which M. Velpeau has given the name of *ai*,[*] or of *tenosité*.[†] We have frequently noticed this disease at the Hôpital Saint Antoine.

If we embrace the swollen part with the palm of the hand, we are conscious of a crepitation which gives a rubbing sound. I lately showed my pupils at the Hôpital Saint Antoine two remarkable examples of this disease situated on the extensors of the thumb. When the ear or the stethoscope was applied to the tumour, a sound was heard like that produced by the rubbing of new leather, and sometimes a sharp musical sound.

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[*] Ai. A Gascon name for a tumefaction of the fibro-synovial membranes of the tendons. *Dunglison's Medical Dictionary.*

[†] Tenosynitis. An imperfectly formed term, signifying inflammation of the synovial sheath of a tendon. *Idem.*

The radius is entirely covered by muscles, so that it is difficult to reach it in front or behind. On the external side, however, it is easily discovered by separating the external radial muscles, and it is at this part that it is most conveniently laid bare when we wish to resect it either in consequence of necrosis or caries, or after wounds or a badly formed callus.

Figure 2.—Transverse Section of the Fore-arm.

EXPLANATION.

A. Circular division of the skin as in a case of amputation of the fore-arm, of the superficial fascia, and of the subcutaneous fatty cellular tissue.
B. Section of the aponeurosis of the fore-arm.
C. Flexor carpi radialis muscle.
D. Flexor sublimis perforatus muscle.
E. Supinator radii longus.
F. External radial muscles.
F′. Aponeurosis separating the radial muscles from the supinator radii brevis.
F″. Aponeurosis separating the two external radial muscles.
G. Extensor communis digitorum and the extensor minimi digiti.
H. Extensor carpi ulnaris.
I. Flexor profundus digitorum.
J. Flexor carpi ulnaris.
K. Supinator radii brevis.
L. Superficial aponeurosis of the anterior surface of the fore-arm covering the supinator radii longus.
M, N. Aponeurosis separating the supinator radii longus from the external radial muscles.
O. Aponeurosis separating the flexor carpi radialis from the flexor muscles of the fingers.
P. Aponeurosis separating the superficial and deep flexors of the fingers.
R. Aponeurosis, or rather the interosseous ligament of the fore-arm.
S. Fibrous septum separating the flexor carpi ulnaris and the flexor sublimis perforatus. (It is in this interspace that the ulnar artery is to be sought for the purpose of applying a ligature).
T. The ulna.
V. The radius.

1. Radial artery.
2. Interosseous artery.
2′. Ulnar artery.
4. Ulnar vein.
5. Radial vein.
6. Interosseous vein.
7. Radial nerve and posterior interosseous vessels.
8. Superficial radial veins.
9. Radial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Figure 2 of this Plate is given to supply the necessary information relating to amputation of the fore-arm and inflammations of the region.

This transverse section of the region of the fore-arm at its centre shows the vessels which must be tied. These vessels are three in number; 1. the radial artery; 2. the ulnar artery; 3. the interosseous artery.

The first vessel to be tied is the radial. This vessel is found in front and near the middle part of the region at about an equal distance from the skin and the radius. It is covered by the inner margin of the supinator radii longus, separated from the skin first by the investing aponeurosis and the supinator longus, and then by the deep aponeurosis which forms the posterior wall of the sheath of this same muscle. It is also seen that the radial nerve is on the outer side of the artery, and that it is almost impossible to include it in the same ligature as the artery.

The second vessel to be tied is the ulnar artery. It is seen to be completely within the stump between the two layers of the muscles belonging to the internal portion of the region of the fore-arm. The ulnar nerve is placed internally to the artery. It is also seen that in order to reach this vessel we must pass into the first intermuscular space, that is to say, between the flexor carpi ulnaris and the flexor sublimis perforatus.

Lastly, the third artery is the interosseous. This artery, as its name implies, is situated in the interosseous space in front of the interosseous ligament. Like all the arteries it is elastic, that is to say, it retracts; but the interosseous ligament does not retract, so that it has occasionally to be sought for at some distance in the substance of the muscles. It may even happen that it is contained in a kind of aponeurotic sheath, and then it retracts to such an extent that it passes out of the sight of the surgeon. He thinks to lay hold of it and only seizes the sheath; he applies a ligature thinking to tie the vessel while the vessel is further off. To remedy this, it is sufficient to divide the sheath from before backwards when the vessel will be exposed and a ligature can then be applied.

We know that the interosseous artery supplies a branch which forms the posterior interosseous, an artery which occasionally comes from the ulnar. This vessel is sometimes of sufficient size to require a ligature. It is seen behind the interosseous ligament. In an amputation we performed some months ago at the Hôpital Saint Antoine, we had no occasion to tie this vessel, and it did not give rise to either primary or secondary hæmorrhage.

In regard to phlegmonous inflammations, we may perceive that they can only extend along the cellular interspaces and interstices of the muscles. These interstices are seen wherever there are vessels, and it is precisely in these parts that we meet with inflammations, phlebitis and inflammation of the lymphatics.

FIG. 1.

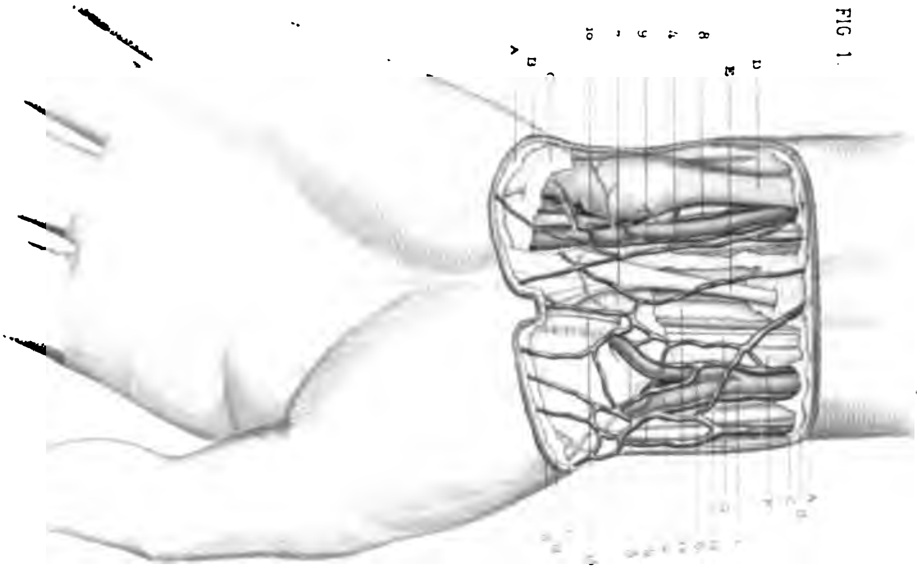

FIG. 2

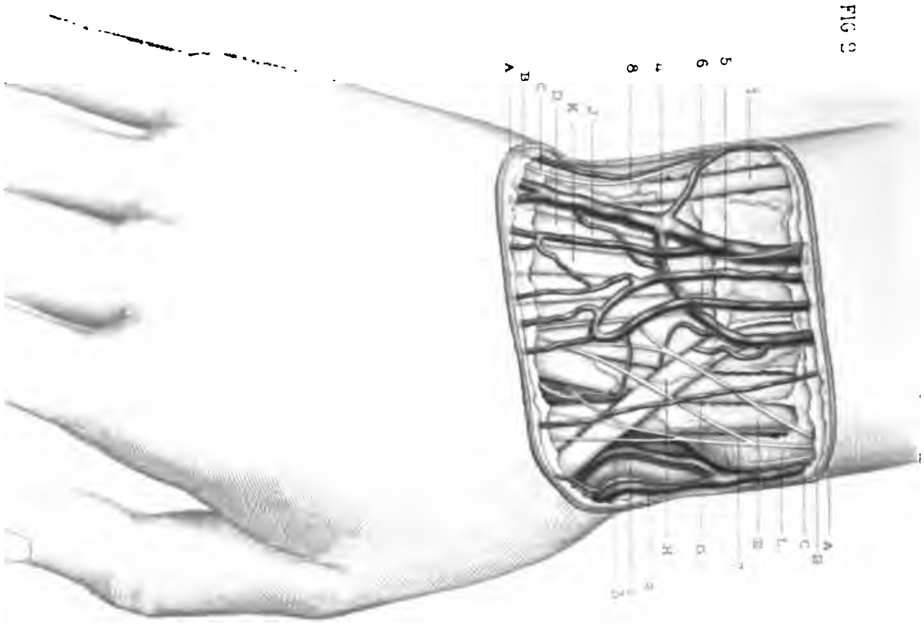

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PLATE LXXXI.

FIGURE 1.—Region of the Wrist.

Anterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Section of the superficial aponeurosis.
D. Tendon of the flexor carpi ulnaris going to be inserted into the pisiform bone and into the base of the fifth metacarpal bone.
E. Tendon of the palmaris brevis continued into the palmar aponeurosis.
F. Tendons of the palmaris magnus and of the flexors of the fingers.
G. Median nerve.
12. Tendons of the flexor sublimis perforatus.

1. Radial artery.
2. Dorsal branch of the radial artery.
3. Palmar branch of the radial artery.
4. Ulnar artery.
5. Superficial veins of the wrist forming a network from which the median and cephalic veins commence
6. Deep veins communicating with the superficial venous network.
7. Veins forming an anastomosis between the superficial and deep network.
8. Ulnar veins.
9. Another deep vein of the region becoming superficial.
10. Ulnar nerve and its relations with the ulnar artery.
11. Radial nerve and its relations with the radial artery.
13. Superficial or cutaneous branch of the median nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The mechanical lesions of the anterior surface of the wrist are all the more frequent because this region is completely exposed. The wounds, contusions and lacerations which do not pass through the superficial aponeurosis have no danger of themselves, but, nevertheless, they are always serious, in consequence of the complications which may accompany them. Phlebitis, inflammation of the lymphatics, phlegmon, and erysipelas are the diseases which sometimes follow these wounds. The delicacy of the skin, the fineness of the subcutaneous cellular tissue, and the minute network of veins and lymphatics account for these secondary inflammations. The injuries which pass through the aponeurosis present a special danger. The radial and ulnar arteries and the radio-palmar branch are situated almost immediately below this membrane. It is scarcely two months ago that I had under my care at the Hôpital Saint Antoine a workman who was wounded at the inner part of the wrist. The ulnar artery was injured and gave rise to a profuse hæmorrhage. The house-surgeon tied both ends of the artery and a cure was accomplished without any drawback. The upper ligature came away on the eighth day, and the lower two days afterwards. The ulnar artery traverses the whole of the region, and becoming more and more superficial it is liable to be wounded. The radial artery only traverses the two-thirds of the internal part of the region and becomes deeper and deeper; it is, therefore, less exposed than the ulnar artery. The radio-palmar trunk which comes from the radial is very superficial, it is true at the base of the hand, but it is soon buried in the midst of the muscles, and is thus protected from injury. But when a cutting instrument passes through the aponeurosis, it may easily reach these vessels, and hence the severe hæmorrhages which sometimes complicate wounds of the wrist. This is owing not only to the size of the arteries that are wounded, but also to the multiplicity and extent of their anastomoses. Hence the necessity of the surgeons seeking for the two ends of the vessel at the bottom of the wound, for if he rests satisfied with tying the upper end, the hæmorrhage will continue from the lower end.

The median nerve having become superficial at the region of the wrist is often injured by transverse wounds. The injury is recognised by the loss of the sense of touch on the palmar surface of the fingers to which it is distributed: the tendons of the palmar muscles, of the superficial or deep flexors may be divided, and the loss of the use of these muscles is the result.

The anatomical arrangement of the synovial sheaths of these tendons as well as that of the cellular sheaths accompanying the arteries, shows that deep-seated inflammations of the palm of the hand may take three directions in order to reach the anterior surface of the fore-arm. In fact, the synovial sheath of the tendons reaches almost to the middle part of the anterior surface of the wrist; from these the inflammation may extend to the cellular tissue around the muscles and the deep vessels. By means of the cellular tissue which accompanies the ulnar artery and the trunk of the radio-palmar and even the radial artery, phlegmonous inflammation easily passes from the palm of the hand to the anterior surface of the fore-arm. The synovial membrane of the wrist, which we shall afterwards see is continued into the palm of the hand, may become inflamed and give rise to fungous growths, to which we shall have to refer hereafter.

Deeper still we meet with the bones forming the skeleton of the region; these are: the inferior extremities of the radius and of the ulna, and the first row of carpal bones. Fracture of the radius is the one which occurs most frequently and arises from falls on the palm of the hand. This fracture was long mistaken for a dislocation of the wrist, but in the present day we know that this dislocation is very rare, while fracture of the radius is very frequent. The disposition of the lower end of the radius, its connexion with the bones of the carpus, and its brittleness readily explain the frequency of these fractures in which the lower fragment is carried backwards, while the upper comes forwards. This gives rise to a characteristic deformity of the wrist, upon which the surgeon depends for forming his diagnosis. Further this fracture cannot be accompanied with much displacement of the fractured portions, because the interosseous space does not exist below, and especially because of the fibrous sheaths and of the number of tendons which surround the radius in nearly every direction. Splints should only be applied when there is much displacement, and even in these cases, we must be careful and soon move the hand and the wrist, if we would avoid stiffness of the articulations and adhesion of the tendons to their synovial sheaths.

FIGURE 2.

Posterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue.
C. Section of the superficial aponeurosis of the region, from the deep surface of which pass off the fibrous septa for the tendons of the muscles belonging to the posterior surface of the region.
D, J, K. Tendons of the extensors of the fingers.
H. Tendon of the extensor longus pollicis.
I. Tendon of the extensor proprius minimi digiti.
F. Tendon of the extensor carpi radialis longior.
G. Tendon of the extensor carpi radialis brevior.
L. Styloid process of the radius giving insertion to the external lateral ligament of the wrist-joint and to the tendon of the supinator longus muscle.

1. Radial artery in the first inter-metacarpal space.
2, 3. Veins accompanying the radial artery.
4. Veins going to form the ulnar vein.
5, 6. Superficial veins of the region.
7. Superficial and cutaneous branches of the radial nerve.
8. Superficial branch of the ulnar nerve.

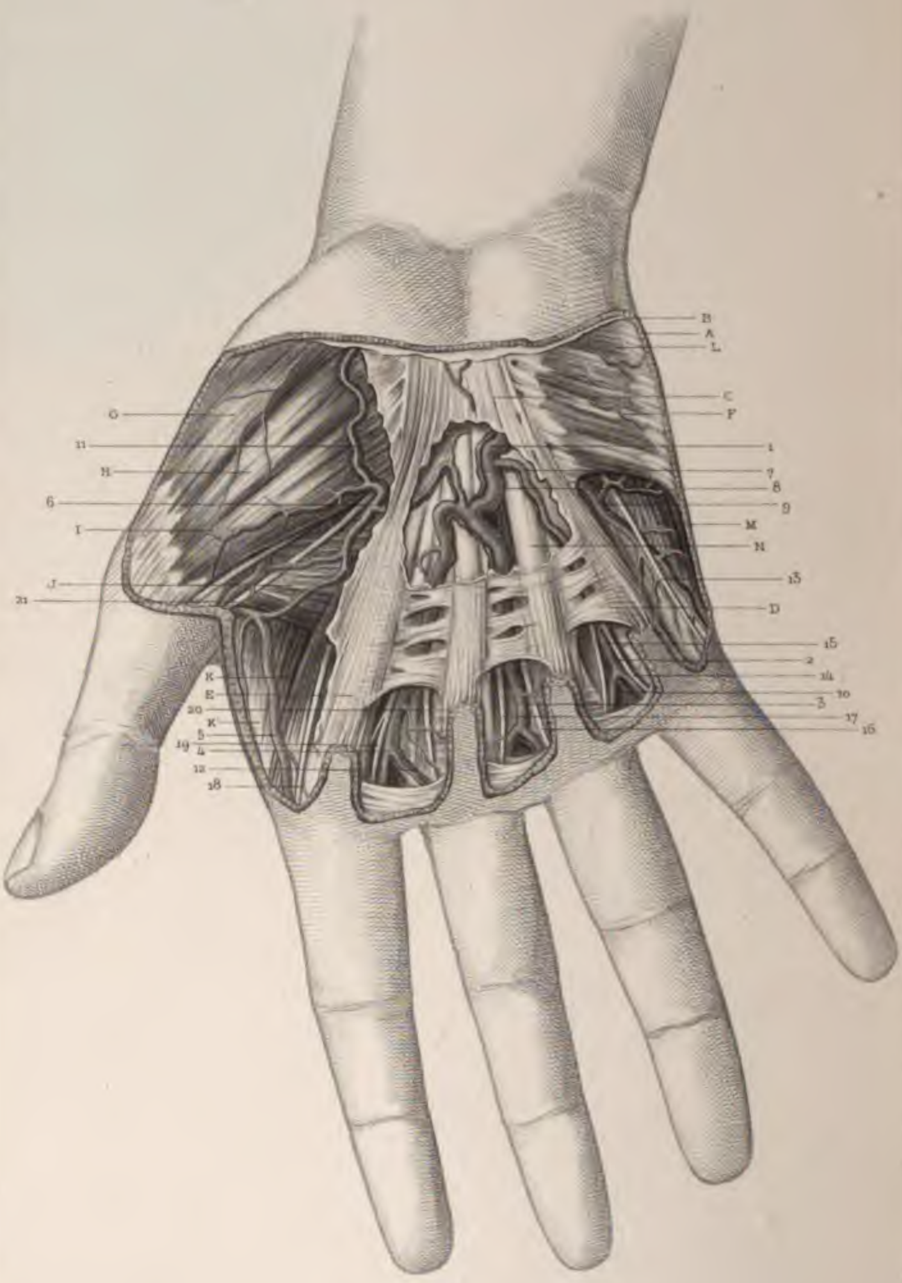
APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Superficial wounds of the surface of the wrist are attended with comparatively little danger, because they only injure certain veins. It is true that wounds of these vessels are followed by phlebitis. Superficial bruises are often followed by effusions of blood which are accounted for by the presence of a very fine venous network composed of vessels of some size. Deep wounds present only one serious and immediate danger, and that is, injury of the radial artery. This vessel is seen to be situated on the external side and at the inferior part of the region, and therefore every wound at this part may be complicated with hæmorrhage.

It is scarcely necessary to say that the division of any of the tendons of the extensor muscles will be followed by loss of power in the corresponding muscle, and it is sufficient to examine each finger in order to ascertain if any of the tendons are wounded.

Two operations are performed in this region: ligaturing the radial artery, and resection of the wrist joint. By forcibly extending the thumb, the tendons of the abductor longus pollicis and of the extensor longus pollicis are made to project posteriorly. In the depression between them, called the anatomical snuff-box *(tabatière anatomique)* the pulsations of the radial artery may be felt. An incision is made in the direction of the abductor longus, the aponeurosis divided on a grooved director, and the artery is found at the bottom of the wound.

With regard to resection, which is often required in consequence of white swelling of the wrist joint, it can only be performed from the posterior surface of the wrist. In fact, how is it possible to remove the inferior extremity of the radius and the ulna by passing from the anterior surface of the wrist? This would only be running the risk of injuring a number of important organs contained in the thick layer of structures covering the diseased bones. In attacking these bones from the posterior surface, there is only a thin layer of soft structures and very few organs of importance. There is, therefore, every advantage in proceeding in this way. Several methods have been proposed, but we prefer that in which there is only two lateral incisions. These incisions allow of the dissection and separation of the sheaths of the tendons, and if the inferior extremity of the ulna is first divided, which is easily done on account of its small size, the radius is reached more easily, as after the removal of the inferior extremity of the ulna a considerable space is left for the movements of the operator. Performed in this way, the operation preserves all the organs intact and is not followed by too long or too profuse suppuration.



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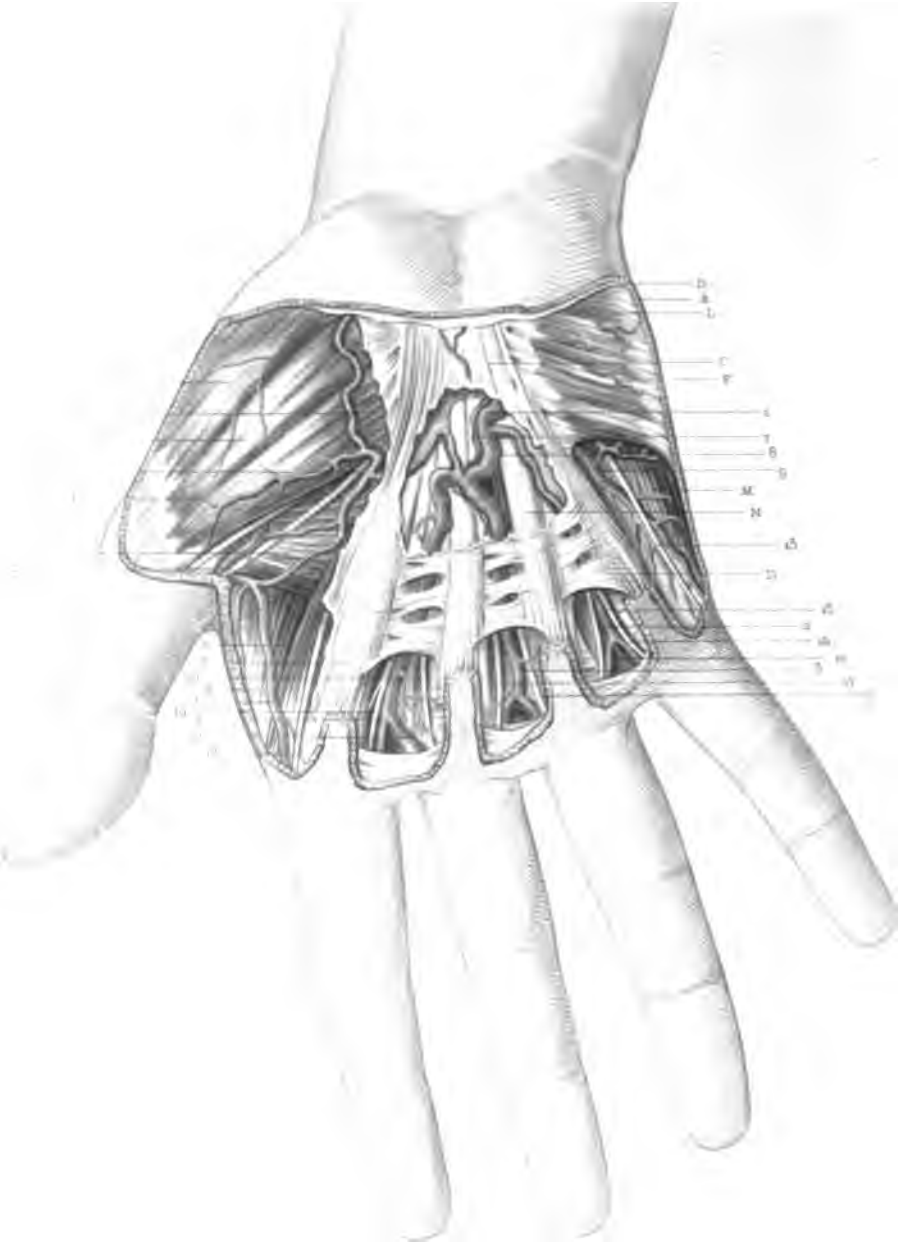

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PLATE LXXXII.

Palmar Region.

Superficial layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous fatty cellular tissue
C. Palmar aponeurosis.
D. Transverse fibres of the palmar aponeurosis. (The intersections of the longitudinal and transverse fibres of the palmar aponeurosis leave intervals through which the subjacent organs are seen, and through which, under some circumstances the pus from sub-aponeurotic abscesses makes its way).
E. Longitudinal fibres of the palmar aponeurosis going to be inserted into the under surface of the skin covering the base of the index finger and the inter-digital space. The same arrangement exists in all the other fingers.
F. Cutaneous palmar muscle inserted externally into the palmar aponeurosis and internally into the under surface of the skin by small aponeurotic tendons.
G. Abductor pollicis brevis muscle.
H. Opponens pollicis muscle.
I. Point of convergence of the two fasciculi of the opponens pollicis muscle.
J. Adductor pollicis muscle.
K. First lumbricalis muscle.
K′. First dorsal interosseous muscle.
L. Superior insertions of the adductor muscle of the little finger.
M. Adductor muscle of the little finger.
N. Tendon of the superficial flexor muscle of the fingers.

1. Superficial palmar arch formed here principally by the ulnar artery. The branch of the radial artery is relatively very small.
2. Branch of the palmar artery furnishing the external digital artery of the little finger and the internal digital artery of the ring finger.
3. Branch of the palmar artery supplying the external digital artery of the ring finger and the internal of the middle finger.
4. Branch of the palmar arch supplying the external digital artery of the middle finger and the internal of the index finger.
5. External digital artery of the index finger coming directly from the radial artery.
6. Superficial branch of the radial artery forming an anastomosis with the superficial palmar arch and anastomosing freely with the radio-palmar trunk of the radial artery.
7, 8. Veins accompanying the superficial palmar arch.
9. External digital artery of the index finger.
10, 11. Veins accompanying the radial artery.
12, 13. Veins accompanying the ulnar artery.
14. Median nerve.
15. Ulnar nerve.
16. Branches of the median nerve going to the abductor brevis, opponens, and flexor brevis pollicis muscles.
17. Internal digital nerve of the thumb.
18. External digital nerve of the index finger.
19. Internal digital nerve of the index finger.
20. External digital nerve of the middle finger.
21. External digital nerve of the ring finger.
22. Internal digital nerve of the middle finger.
23, 24. Internal and external digital nerve of the little finger.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

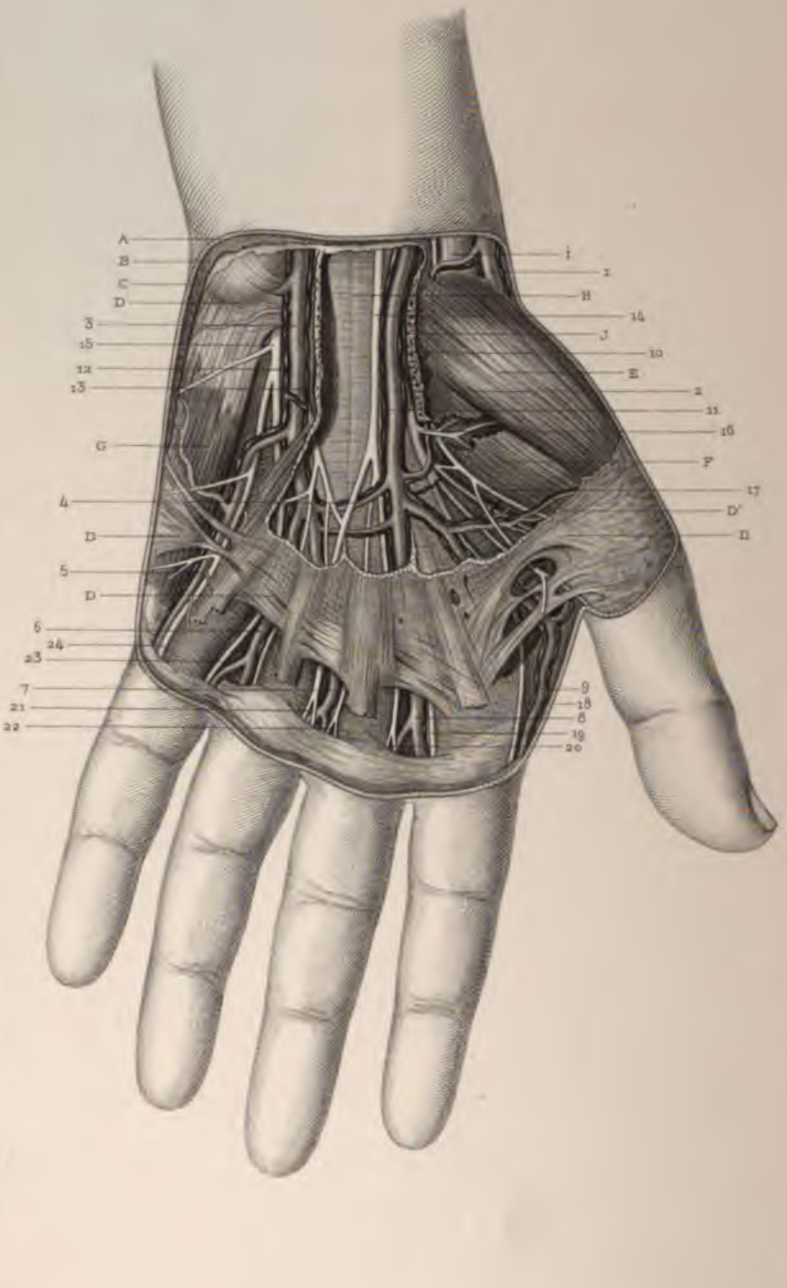
The superficial layer of the palm of the hand includes the skin, the subcutaneous fatty cellular tissue, and the palmar aponeurosis; it is to these different tissues that the following remarks refer.

Wounds and lacerations of the skin of the hand are very frequent, but they heal readily and frequently by the first intention, because there is not much separation between the lips of the wound. The connexion which exists between the skin and the palmar aponeurosis at various points, prevents the skin from being raised up, and also the separation of the lips of the wound. It is undoubtedly the want of extensibility in the skin added to the abundance of its nerves which explains why inflammation in this part is so exceedingly painful. When the wound is deeper and involves the aponeurosis itself, it is not any more dangerous, because this part is neither vascular nor painful, and there is nothing to prevent union of the skin taking place. In this case, however, where a longitudinal wound has divided the transverse fibres of the aponeurosis throughout their whole extent, the wound would present a considerable amount of separation, and might require a suture.

Superficial bruises of the palm of the hand are situated sometimes on the exterior of the skin, sometimes in the skin itself, and lastly, sometimes in the subdermal tissue; they differ according to the part in which they occur. Thus, those which occupy the thenar and hypothenar eminences have no special characters. Those, on the contrary, which occupy the other regions of the palm of the hand will have three positions; thus, in the case of a very slight contusion a small ecchymosis is produced beneath the skin; in one that is more severe there will be a raising up of the epidermis by a sero-sanguineous effusion. The pain will be very acute, and the vesicle will remain for a longer or shorter time according as to whether it opens and allows its contents to escape, or that the serum is absorbed and it dries up; if the contusion extends to a greater depth, the adhesions of the skin to the palmar aponeurosis will not allow of effusion taking place between the two membranes, and hence the symptoms of contusion are often unperceived because the lesions which follow are situated beneath the palmar aponeurosis.

Rich in blood vessels and lymphatics the skin of the palmar region may become inflamed either spontaneously or in consequence of wounds and contusions. When inflammation attacks the tissues of which we are speaking, there is little fear of diffuse or of circumscribed phlegmon, but on the contrary of erysipelas, of inflammation of the lymphatics, or of phlebitis. It is not, however, entirely so with regard to the thenar and hypothenar eminences, because here the palmar aponeurosis is not so intimately united to the skin, nor is it so thick as to limit the inflammation to such or such a layer.

Vital alterations of the skin and of the subjacent layer are not uncommon. Thus, in workmen, the constant friction of their tools against the skin of the hand produces a thickening of the epidermis, giving rise to corns and



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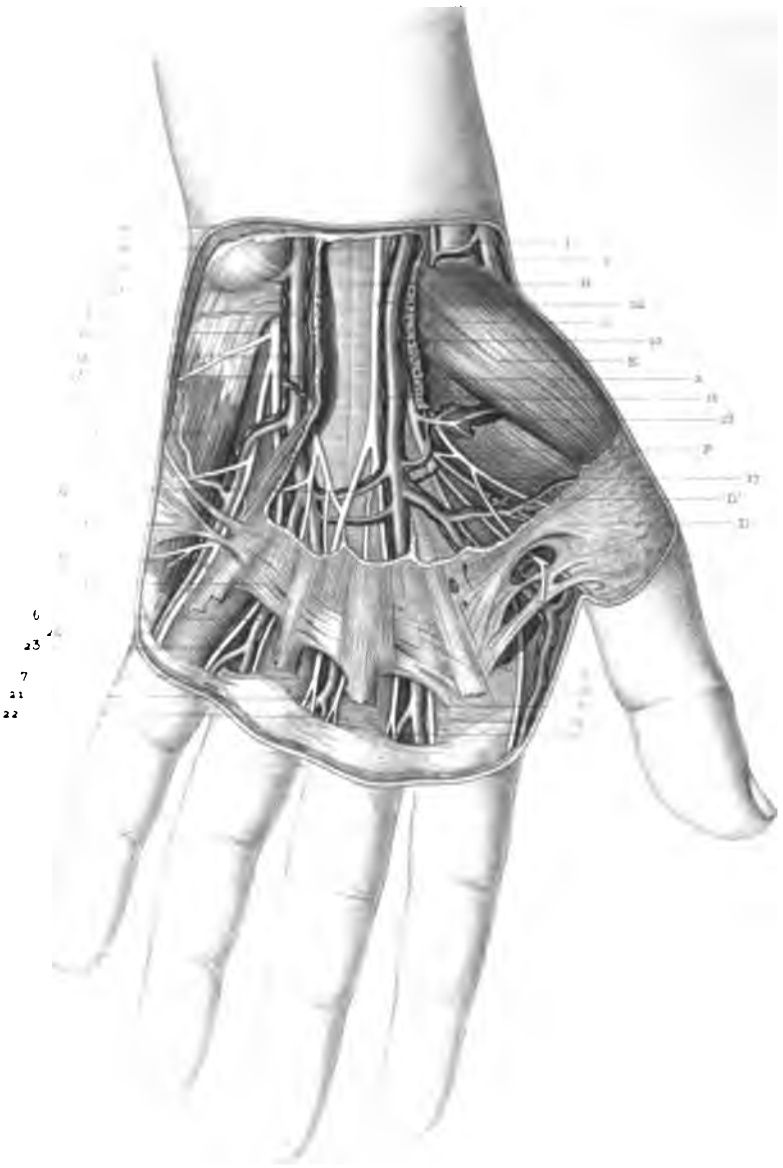
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PLATE LXXXIII.

Palmar Region.

Second layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue and of the superficial fascia.
C. Section of the palmar aponeurosis. In following this aponeurosis from this point towards its superior and external part, it is easily seen that the aponeurosis sends off from its inferior surface two fibrous septa which divide the palm of the hand into three compartments. The middle compartment contains the flexor muscles of the fingers and the important vessels and nerves of the region; the two lateral compartments contain similar organs, but of somewhat less importance.
D. Transverse fibres of the palmar aponeurosis in various parts of the region.
D′. Section of the palmar aponeurosis.
E. Abductor pollicis brevis muscle of the thumb.
F. Opponens pollicis muscle.
G. Adductor minimi digiti muscle.
H. Tendons of the flexor muscles of the fingers contained in their synovial sheaths and seen through an opening of the fibrous sheath formed by the palmar aponeurosis.
I. Tendon of the flexor carpi radialis muscle.
J. Section of the external septum of the palmar aponeurosis.

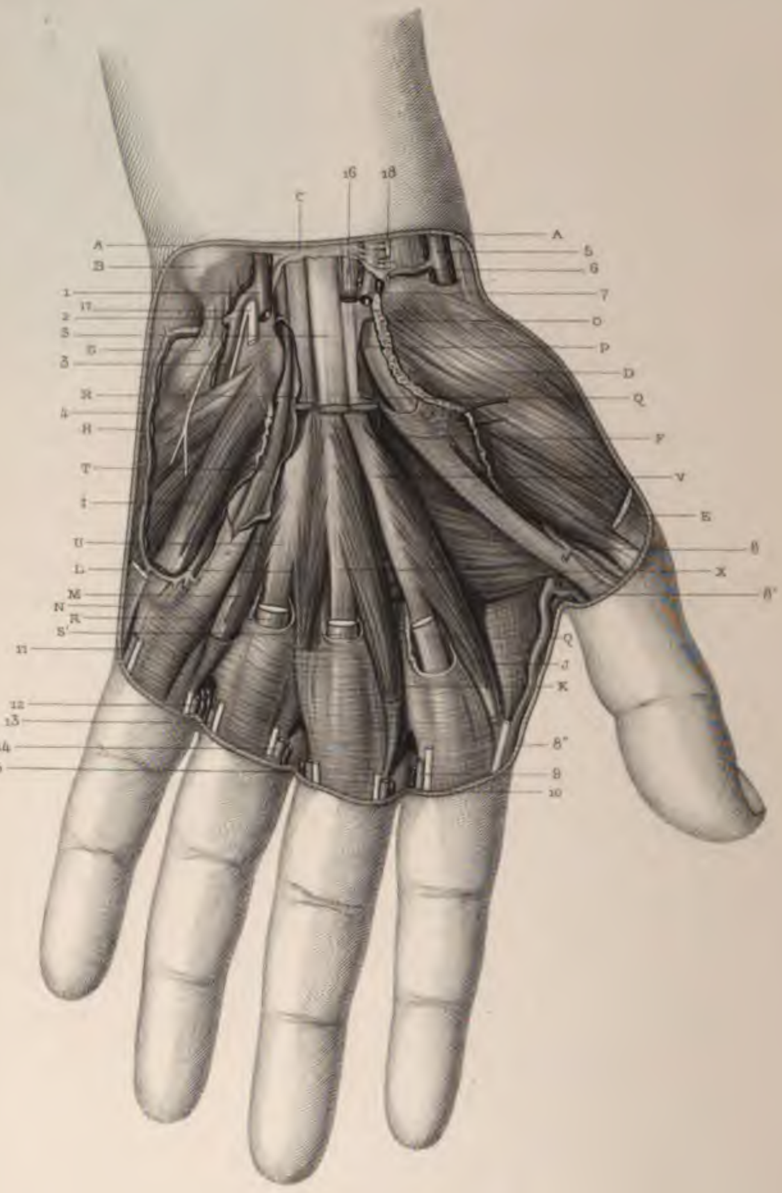
1. Dorsal branch of the radial artery.
2. Palmar branch of the radial artery.
3. Ulnar artery.
4. Double anastomosis between the radial and ulnar arteries, replacing the palmar arch.
5. Internal digital artery of the little finger.
6. Branch of the ulnar artery dividing into the external digital of the little finger and the internal of the ring finger.
7. Branch of the ulnar artery furnishing the external digital artery of the ring finger and the internal of the middle finger.
8. Branch of the radial artery giving off the external digital artery of the middle finger and the internal of the index finger.
9. External digital artery of the index finger.
10, 11. Veins accompanying the radial artery.
12, 13. Veins accompanying the ulnar artery.
14. Median nerve.
15. Ulnar nerve.
16. Branches of the median nerve furnished to the thenar eminence.
17. Internal digital nerve of the thumb
18. External digital nerve of the index finger.
19. Internal digital nerve of the index finger.
20. External digital nerve of the middle finger.
21. External digital nerve of the ring finger.
22. Internal digital nerve of the middle finger.
23, 24. Internal and external digital nerves of the little finger.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate is intended to show some of the anatomical details belonging to the structure and relations of the palmar aponeurosis and of the organs it covers. We would direct the attention of the surgeon to the transverse fibres of this membrane which are very compact towards its central part, but become more irregular on the thenar and hypothenar eminences, where it forms a kind of cellular fascia. We would also point out the longitudinal fibres which are divided opposite the root of each finger, where they form a band which is inserted into the under surface of the skin belonging to the palmar surface of each finger, and at the same time to that which covers the interdigital space. Here may be seen the septa which are formed from the under surface of the aponeurosis, and which are two in number, serving to mark off three compartments in the palm of the hand. The middle compartment contains the tendons and their sheaths, the lateral compartments are represented by the thenar and hypothenar eminences.

Amongst the sub-aponeurotic organs we may mention the arteries and nerves, as well as the synovial sheath. These organs being known, we can understand the danger of wounds which penetrate beyond the palmar aponeurosis. An instrument of prehension, the hand has received an admirable organisation, which preserves it from the effects of external injuries by means of this palmar aponeurosis. But the violence of blows and shocks is sometimes so great that the septum which served as a protection is destroyed, and the most serious results are produced. Thus, whether the instrument is pointed, or adapted for cutting, or for bruising, the vessels, the nerves, and the tendons with their sheaths may be wounded.

But, which are the vessels that are exposed to these injuries? They are the arteries which contribute to the formation of the superficial palmar arch and the palmar arch itself. The radio-palmar trunk is seen to descend a little to the outer side of the median line, internal to the external septum of the palmar aponeurosis; arrived at the middle of the region it anastomoses by two transverse branches with the ulnar artery. It must be understood the present Plate does not represent the normal arrangement of the superficial palmar arch. Nevertheless, the arrangement we have represented is not uncommon, and, moreover, the same inferences are to be drawn from this as from any other. Whenever an instrument has penetrated near the middle of the hand, we have to fear injury of this arterial arch or of the vessels which form it. It is scarcely necessary to insist upon all the dangers attending these wounds, not only on account of the hæmorrhage they give rise to, but also because they are accompanied with a number of other lesions of the neighbouring organs. Looking only at the danger which may arise from wounds of the arteries, if the vessel is completely divided and we are called immediately after the accident we shall ascertain that the blood escapes in jets, or if it has ceased to flow that a considerable quantity has been lost. What, therefore, should be done? If we avoid probing the wound for fear of destroying the work of reparation which has already commenced, and apply slight compression, this is of little use, and at the same time dangerous; of little use because the palmar aponeurosis forms an almost



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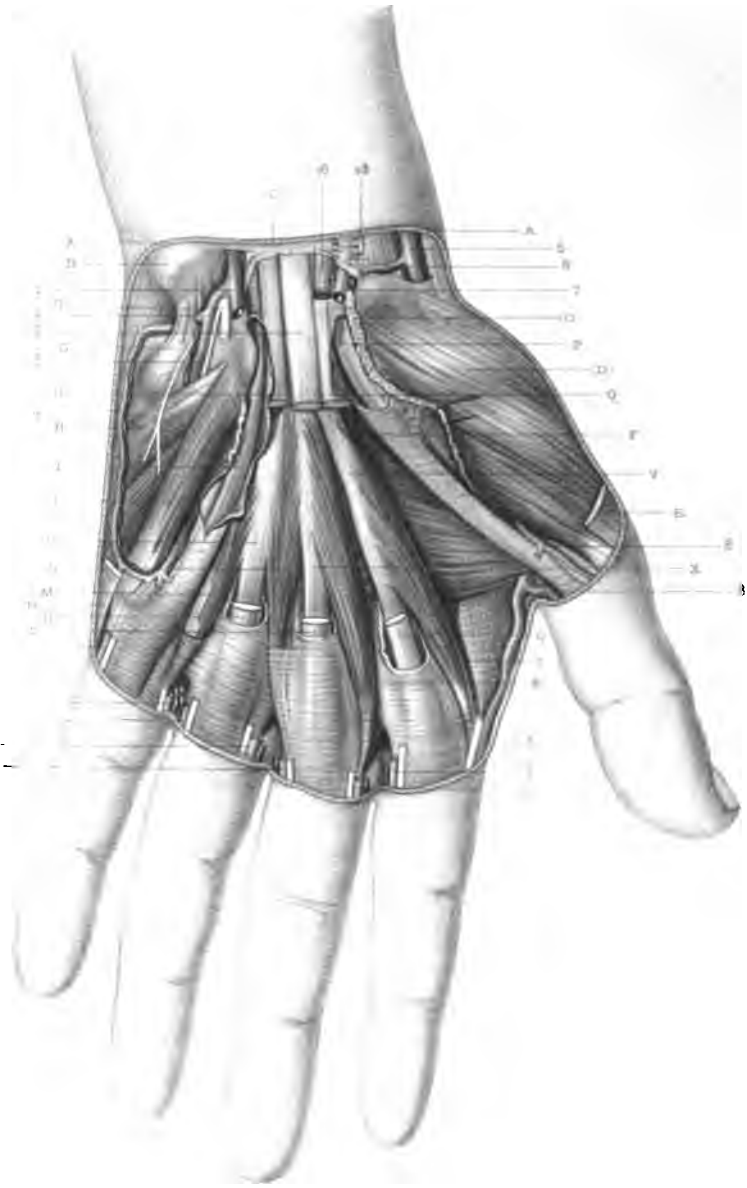

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PLATE LXXXIV.

Palmar Region.

Third layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of superficial fascia and of the subcutaneous fatty cellular tissue.
C. Section of the palmar aponeurosis.
D. The flexor brevis pollicis muscle.
E. Tendon of the abductor pollicis brevis and of the opponens pollicis muscles.
F. Abductor pollicis muscle.
G. Anterior ligament passing from the ulna to the carpus.
H. Abductor muscle of the little finger.
I. Opponens muscle of the little finger.
J. First lumbricus muscle.
K. Second lumbricus muscle.
L. Third lumbricus muscle.
M. Fourth lumbricus muscle.
N. Tendon of the short flexor muscle of the little finger.
O. Section of the fibrous septum which bounds externally the middle sheath of the palm of the hand.
P. Opening of the sheath of the tendon which bends the thumb.
Q. R. Tendons of the superficial flexor muscle of the fingers.
Q′, R′, S. Tendons of the flexor sublimis or superficial flexor enclosed in their special sheaths which are independent of the great synovial sheath of the palm of the hand.
T. Tendons of the flexor sublimis going to the little finger and seen through an opening in the synovial sheath which accompanies it in the whole of its course. It is here seen that the thumb and the little finger alone present a communication between their synovial sheath and the common synovial sheath of the wrist.
U, V, X. Tendons of the deep flexor muscle of the fingers.

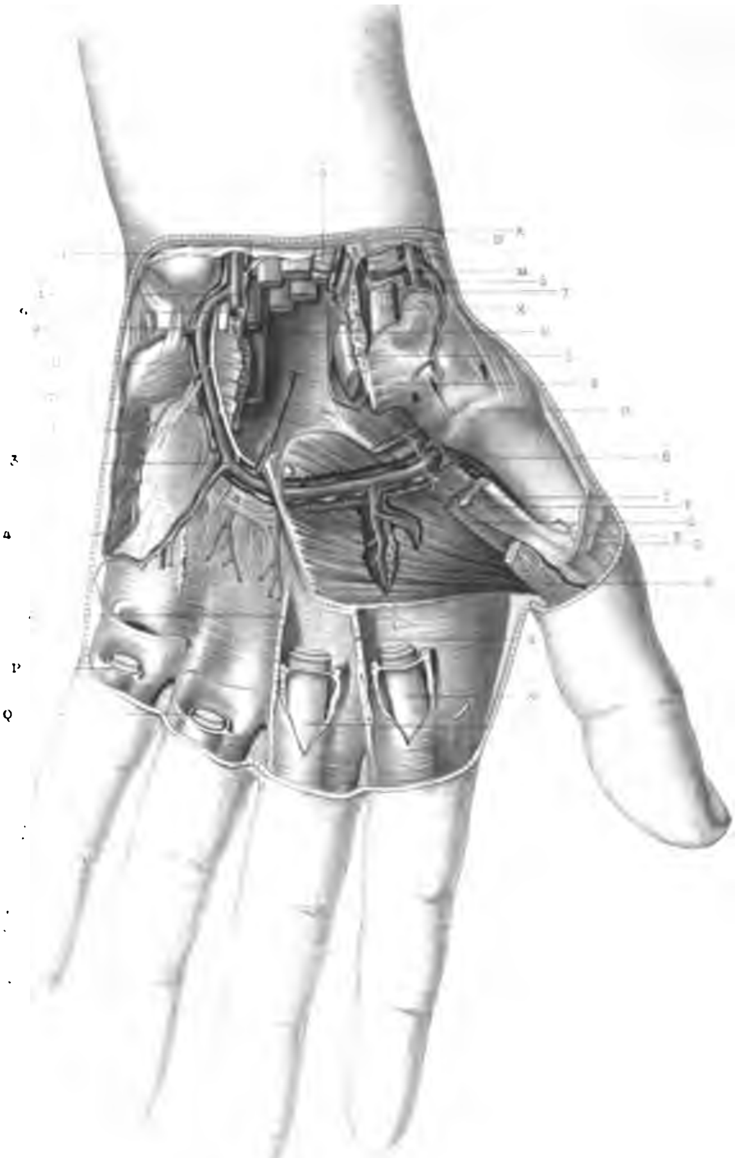
1. Trunk of the ulnar artery.
2. Deep branch of the ulnar artery.
3. Branch of the deep division of the ulnar artery going to form the deep palmar arch.
4. Internal branch of the deep ulnar artery anastomosing with a branch of the same artery, and giving rise to the internal digital artery of the little finger.
5. Radio-dorsal artery.
6. Radio-palmar trunk.
7. Trunk of the radial going to form the superficial palmar arch.
8. External digital artery of the thumb.
8′. Internal digital artery of the thumb.
9, 10, 11, 12, 13, 14, 15. Digital vessels and nerves of the fingers.
16. Median nerve.
17. Ulnar nerve furnishing deep muscular branches.
18. Cutaneous nerve coming from the median nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate serves to complete the information which is required to enable us to understand the importance of wounds of the palm of the hand which extend to the organs beneath the aponeurosis. Thus we have here the anatomical details which give a clear explanation of the special danger attending certain wounds of the little finger and of the thumb. In fact, it had long been noticed that wounds which extended to the sheaths of these fingers were often followed by inflammation of the palm of the hand and even of the wrist. It was perceived that the communication existing between these sheaths, and the common synovial membrane of the wrist readily explained this extension. The communication between these synovial membranes is here seen. The thin middle fingers have each a separate tendinous sheath. Wounds which penetrate to the common synovial membrane may divide the tendons of the superficial and deep flexor muscles or even the lumbricales muscles when they occur at the middle part of the region. At the lateral parts we meet with the fleshy masses forming the thenar and hypothenar eminences whose wounds do not offer the same danger. Nevertheless, on the inner side of the region it is seen that the hypothenar eminence is traversed by two branches of the ulnar artery, the one superficial, the other deep, both of which might be the seat of hæmorrhage. Lower down, the arterial branches, which arise from the palmar arch, and from the digital arteries, are of sufficient size for their wounds to be followed by a considerable flow of blood. The median nerve may also be involved in the wounds we have been considering.

With regard to inflammation, it may be said that it will follow the course either of the sheaths of the muscles and thus easily extend to the wrist, or that of the sheaths of the vessels, and so reach the forearm. At the lower part of the region, when the inflammation attacks the sub-aponeurotic cellular tissue, the inflammation, the ædematous infiltration and the pus follow two different directions. The inflammation being circumscribed by the aponeurosis cannot readily develop itself, and therefore passes to the back of the hand through the interdigital spaces which contain a delicate cellular tissue that readily inflames, from there the inflammation extends to the cellular tissue of the dorsal surface, so that frequently the first indication of a sub-aponeurotic inflammation of the palm of the hand shows itself on the dorsal surface of this organ. At other times, the inflammation and the pus follow another course. They pass through the mesh of the palmar aponeurosis, become subcutaneous and the abscess opens by raising up the epidermis on the palm of the hand. If this epidermis is hard, thick, and callous, it is not easily raised up, it resists and then the pus separates it to a considerable extent; there are then two spaces, the one beneath the epidermis, the other beneath the aponeurosis communicating with each through the interstices of the palmar aponeurosis; it is what M. Velpeau has called *un abcès en bouton de chemise*.

When the synovial membrane is inflamed, the tendons which are covered by it, can no longer move with the same facility, and so long as there is no dropsy, that is to say no exhalation of a considerable quantity of fluid, these tendons produce a characteristic crepitating sound, similar to that which we have mentioned exists in the course of the tendons of the long extensor and abductor muscles of the thumb.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXXV.

Palmar Region.

Fourth layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the fatty subcutaneous tissue.
C. Section of the palmar aponeurosis.
D. Section of the abductor pollicis brevis muscle.
E. Section of the flexor brevis pollicis muscle.
F. Section of the opponens pollicis muscle.
G, H. Section of the opponens and flexor brevis pollicis muscles.
I. Adductor pollicis muscle.
J. Fibres of the palmaris brevis going to be inserted into the skin.
K. Tendon of the flexor carpi radialis passing in front of the radio-carpal articulation, and entering, behind the abductor pollicis brevis and the opponens pollicis muscles, a groove in the trapezium which is situated in front of the superior extremity of the second metacarpal bone.
L. Tendon of the flexor longus pollicis.
M. Tendons of the superficial and deep flexors of the fingers.
N, O, P Q. Tendons of the superficial and deep flexors contained in their fibro-synovial sheath which is divided and laid open above.
R. Trapezo-metacarpal articulation of the thumb with its ligaments.
S. Projection of the trapezium into which is inserted the fibrous septum of the palmar aponeurosis.
T. Ligament which unites the unciform bone with the superior extremity of the fifth metacarpal bone.
U. Section of the anterior annular ligament of the carpus beneath which passes the organs contained in the middle portion of the palm of the hand.
V. Anterior surface of the fibrous sheath of the middle portion covered by the synovial membrane.
X, Z. Deep insertions of the fibrous septa which are given off from the deep surface of the palmar aponeurosis.

1. Ulnar artery before its division into its superficial and deep branches.
2. Deep branch of the ulnar artery dividing into smaller branches.
3. Branch of the ulnar artery going to form the deep palmar arch, and anastomosing with the radial artery.
4. Anastomotic arch formed by the secondary branches of the ulnar.
5. Dorsal branch of the radial artery passing along the first interosseous space to form the deep palmar arch.
6. Deep palmar arch.
7. Branch of the radial going to assist in the formation of the deep palmar arch.
8. Median nerve.
9. Ulnar nerve going to be distributed to the deep muscles of the palm of the hand.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate is very instructive with regard to the arrangements and relations of the deep palmar arch, and with which the surgeon is concerned in the case of deep wounds of the palm of the hand. Placed a little higher than the superficial palmar arch, and at a considerable depth, not only beneath the palmar aponeurosis, but also beneath the tendons of the flexor muscles of the fingers, this arch would seem to be placed beyond the reach of injuries or wounds; this, however, is not the case, and frequently the force of the instrument is such that the hand is pierced through, so that both the arches are wounded at the same time.

A wound of the palm of the hand may present three conditions: 1. wound of the superficial palmar arch 2. wound of the deep palmar arch, 3. wound of both the superficial and of the deep palmar arch. Let us examine what happens in these three cases. We have already pointed out the rules which should guide the surgeon in the case of a simple wound of the superficial palmar arch only; we will, therefore, now speak of wounds affecting the deep palmar arch only. In consequence of the depth at which the vessel is placed, it will in the first instance be difficult to determine whether the blood comes from the palmar arch; it is only after a careful examination of the wound, of the manner in which the discharge of blood takes place, and ascertaining that the tendons and nerves are injured, we can satisfy ourselves that the blood comes from this arch. Ought we in this case to search for the two ends of the vessel? I think not; moreover, it is not so necessary, because direct compression will be here more efficacious, and at the same time neither so painful nor so dangerous. If compression does not succeed, and especially if it has been ascertained that the two ends of the artery cannot be found, compression must be made upon the radial and ulnar arteries at the wrist, and if this also fails, then these arteries must be ligatured.

When both the arches are wounded at the same time, it may happen that the surgeon, forming an imperfect diagnosis, only recognises the wound of the superficial palmar arch, and after tying the two ends of the vessel finds the flow of blood still continues. Upon consideration, he will conclude that the blood comes from the deep palmar arch. How often has a wound of the superficial palmar arch been thus mistaken and the bleeding attributed to secondary hæmorrhage from the superficial arch? It is, therefore, exceedingly important to form a correct diagnosis in order to avoid these erroneous conclusions.

In this Plate is seen the posterior surface of the fibro-synovial membrane of the tendons of the palm of the hand. This membrane forms, so to speak, an integral part of the anterior ligaments of the carpal and carpo-metacarpal articulations. An artery of some size penetrates through this membrane into the articulations of the carpus, a circumstance which readily explains the sympathy which exists between the synovial membranes of the carpal articulations and those of the tendons in the palm of the hand. It is no doubt in consequence of this, that, for instance, fungous growths of these synovial membranes are capable of extending from one to the other.

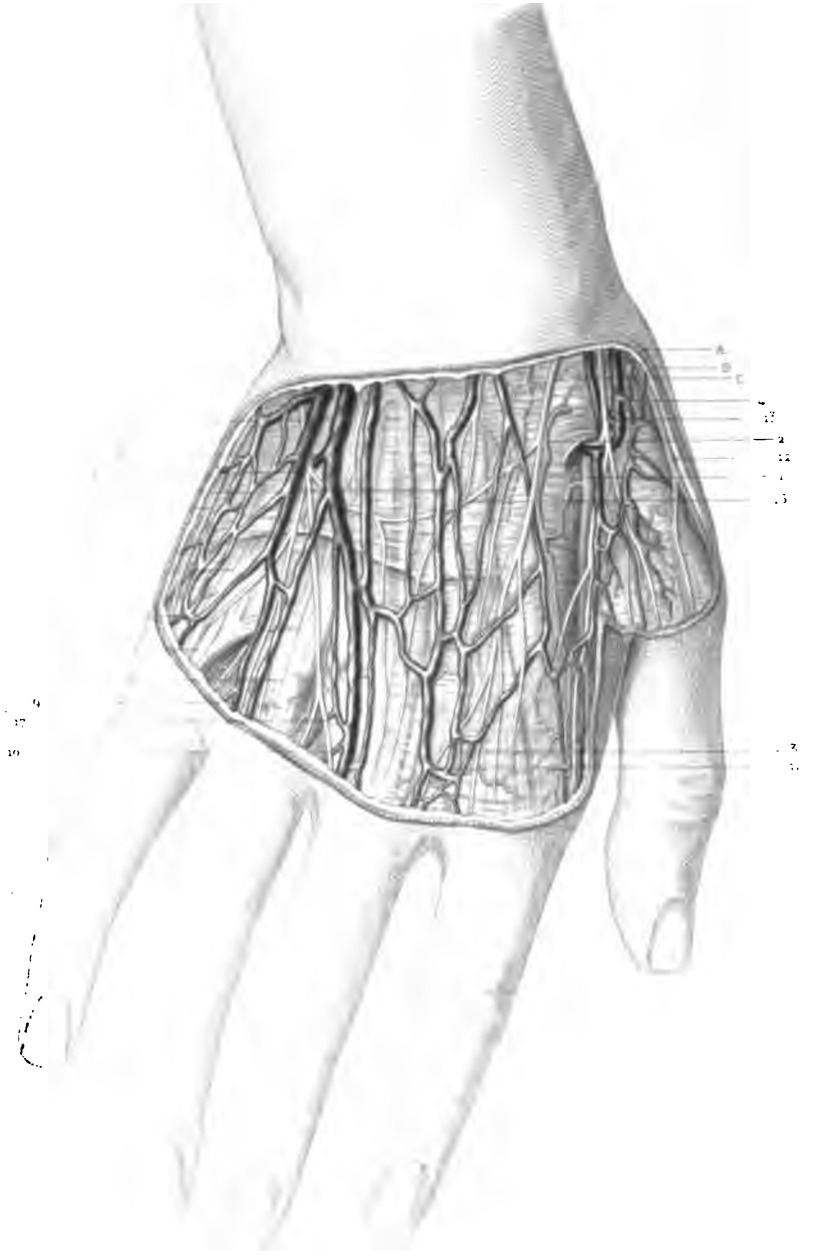

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PLATE LXXXVI.

Dorsal Region of the Hand.

First layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue and of the superficial layer of the superficial fascia.
C. Deep layer of the superficial fascia. (There are few regions where these two layers are more distinct).
D. Superficial aponeurosis of the dorsal surface of the hand.
E. Tendon of the extensor of the little finger covered by the superficial aponeurosis.
F. Tendon of the extensor of the fourth finger covered by the superficial aponeurosis.

1. Radial artery (dorsal branch) going to form the deep palmar arch.
2. Superficial or subcutaneous branch furnished by the radial artery.
3. Branch of the radial artery furnishing smaller branches to the dorsal surfaces of the middle and indicator fingers.
4. Cephalic vein of the thumb communicating with the deep vessels of the fore-arm.
5, 6. The venæ salvatellæ going to form the superficial posterior ulnar veins.
7. Dorsal veins of the hand forming a free communication between the posterior, superficial, radial and ulnar veins.
8. Origin and branches of the vena salvatella.
9. Dorsal veins of the little finger.
10. Dorsal veins of the fourth finger.
11. Dorsal veins of the middle and index finger.
12. Dorsal nerve of the thumb.
13. Nerve supplying the internal dorsal branch of the thumb and the external dorsal branch of the index finger.
14. Branch of the ulnar nerve furnishing the dorsal nerves of the middle, ring and little fingers, also an anastomosis between the branches of the radial and ulnar nerves.
15. Internal dorsal nerve of the little finger.
16. Anastomosis between the radial and ulnar nerves.
17. Internal dorsal nerve of the middle finger.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

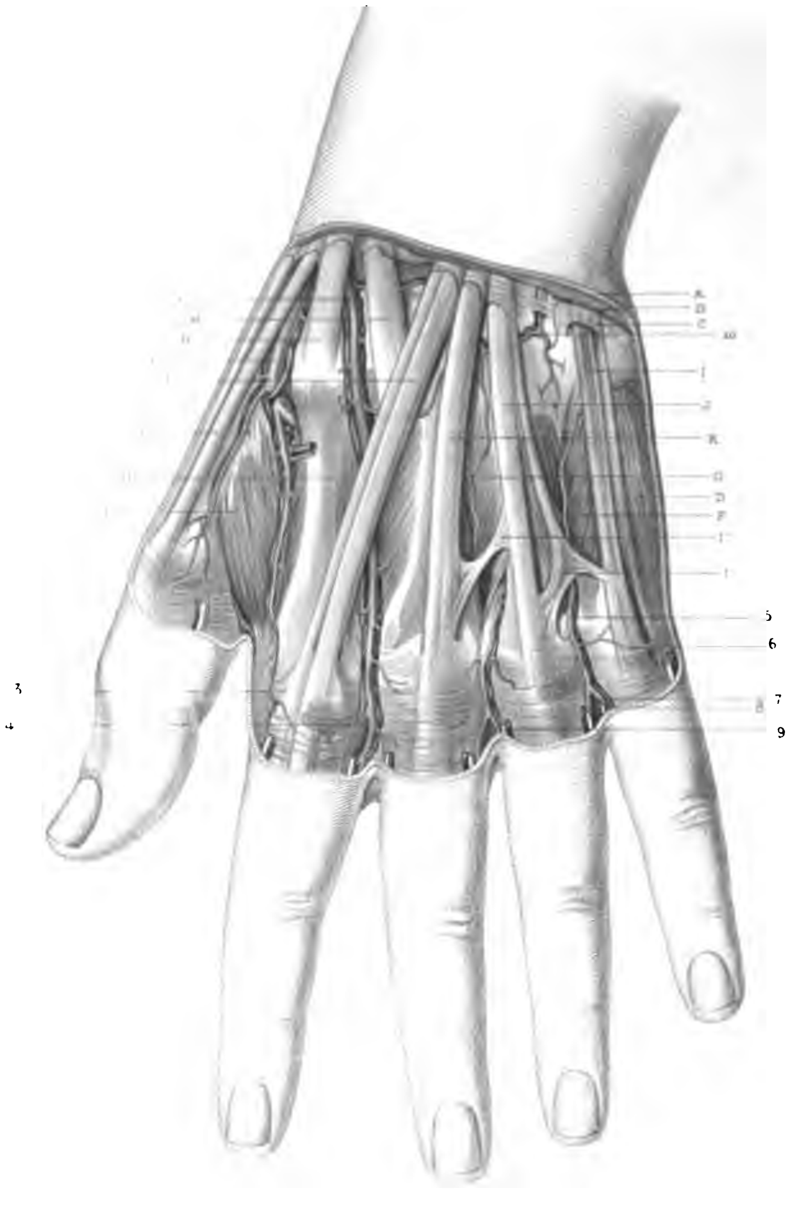
The structures we have to study here are the skin, the subcutaneous tissue, and the two fascias, together with the vessels which are placed between them.

Wounds in this part are not dangerous; if they pass through the skin they may reach the veins, which, however, will soon cease bleeding. Yet a wound situated on the outer side of the region might injure the posterior carpal branch of the radial, which is here of sufficient size to give rise to hæmorrhage. All the other arteries which accompany the superficial veins or ramify beneath the skin are incapable of furnishing any considerable amount of blood. In contused wounds, the rupture of the superficial vessels sometimes produces a large effusion of blood either beneath the skin or between the two layers of the fascia which are here very distinct.

Inflammation of this layer often commences in the palm of the hand, and especially at the roots of the fingers. When it occupies the cellular tissue, it is accompanied by a considerable amount of swelling and great puffiness, giving rise to the impression of fluctuation; this rapid development of the inflammation and the infiltration of the cellular tissue arises from the extensibility and laxity of the latter tissue. The abscess presents itself sometimes beneath the skin, sometimes in the cellular tissue, sometimes between the two layers of the superficial fascia, around the veins, lymphatic vessels and nerves; lastly, sometimes between the deep layer of the superficial fascia and the aponeurosis of the region. These abscesses should be opened early; they are not of a serious character, inasmuch as they naturally and quickly make their way towards the skin.

Amongst the tumours which occur at the upper part of the region and are common to that and the region of the wrist, we must mention those which are termed *ganglions*. These are synovial cysts commencing in one of the synovial bursæ, or a kind of hernia of the synovial membranes which accompany the tendons or cover the numerous articular surfaces in that part of the hand corresponding to the carpus.

In regard to operative surgery, we may observe, that the soft parts which we have just examined have no great thickness, neither is it dangerous to pass through them, and consequently we can easily attack the bones and the articulations of the carpus and the metacarpus.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXXVII.

Dorsal Region of the Hand.

Second layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Section of the superficial aponeurosis.
D. Adductor muscle of the little finger.
E. First dorsal interosseous muscle.
F. Fourth dorsal interosseous muscle.
G. Third dorsal interosseous muscle.
H. Second dorsal interosseous muscle.
I. Tendons of the common extensors and of the long extensor proper to the little finger.
I′, I″. Tendinous expansions which unite the tendons of the extensors of the fingers.
J, K, L. Tendons of the common extensors of the fingers.
M, N. Tendons of the extensor carpi radialis brevior and of the extensor carpi radialis longior muscles.
O. Tendons of the extensors of the thumb.

1. Dorsal branch of the radial artery going to form the deep palmar arch.
2. Branch of the radial artery occupying the second inter-metacarpal space and furnishing the dorsal arteries of the middle and index fingers.
3. External dorsal artery of the index finger.
4. Artery dividing into two branches for the middle and index fingers.

5, 6, 7, 8, 9. Dorsal branches of the ring and little fingers.
10. Anastomosis between the branches of the radial and ulnar arteries forming a true dorsal arterial arch.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds which reach the deep layer of the dorsal surface of the hand are more serious than those previously referred to, because the vessels, nerves and tendons may be wounded, not only on the dorsal surface, but also on the palmar surface when the instrument inflicting the wound passes through the interosseous spaces.

The arteries which may be wounded are the interosseous, which become larger as we approach the thumb, and are distributed to the dorsal surface of the fingers. These vessels are small, and if they were opened, a slight amount of compression would be sufficient to arrest the hæmorrhage.

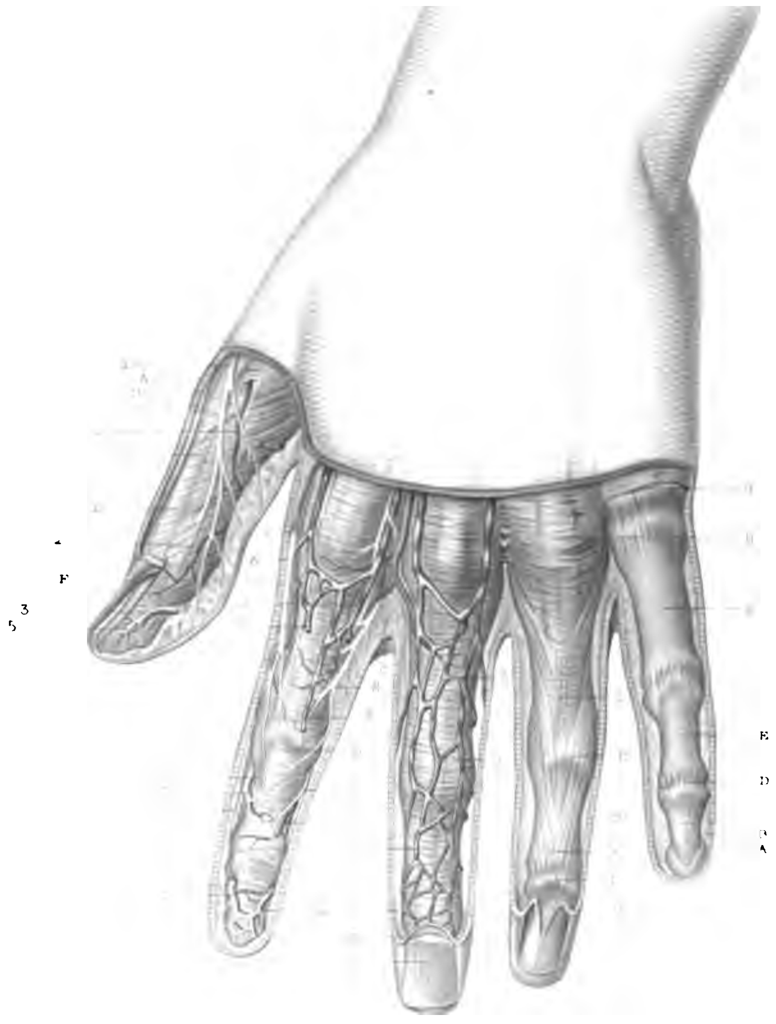
The tendons of the extensors of the fingers are often partially or completely divided. When only partially divided, the extension of the corresponding finger is not immediately abolished, but if inflammation supervenes it may destroy the remainder of the tendon which allowed of the continuation of the action, and then a separate cicatrisation of the two ends may occur, which will for ever destroy the extension of the finger. To prevent this, the fingers must be rendered immoveable to prevent inflammation, and to combat it if it should supervene; lastly, the cicatrisation must be watched in order that the tendon may become united and not confounded with the skin or the other tendons in one common cicatrix.

When one or several tendons are completely divided, the extension of the corresponding finger is completely prevented. This lesion is, therefore, serious, because it compromises the use of the fingers and of the hand. For this reason, the surgeon should endeavour to preserve the functions of the fingers and of the hand intact. If he is called immediately after the accident, after such attentions as are paid to every wound, he should endeavour to unite the two ends of the divided tendon by suture. Although the fibrous communications which exist between the exterior tendons, and which are here carefully represented, form an obstacle to the separation of the divided extremities, it sometimes happens that they are separated more than a centimetre (0·397 English inch). The surgeon then seeks for the two ends and applies a suture, either passing it through the whole thickness of the tendon or merely through its superficial layer.

When we were house surgeon at the Hôpital de Clinique, a pupil divided the extensor of his middle finger in opening his window, in consequence of the glass being broken. M. Gosselin, who was called at the same time as ourselves, applied the suture by passing it through the whole thickness of the tendon. Union was complete, and the functions of the finger restored.

If the interosseous muscles should be divided, the parts must be rendered immoveable. At the present time, we have a patient who has had his hand crushed, all the tissues were broken up against the metacarpal bones, so that there was a communication between the palmar and dorsal surface of the hand.

Fractures of the metacarpal bones are not uncommon, and nearly all of them are caused by direct violence. The first metacarpal bone is one that is most exposed. We met with three cases in one day at the Hôpital St. Antoine. In all three patients the fracture was the result of a blow of the fist. The fifth metacarpal is the next in order of frequency. The middle metacarpal bones are less frequently fractured. In these cases there is not much displacement, because the other metacarpals act as splints when one of them is broken.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXXVIII.

Region of the Fingers.

Dorsal surface.

EXPLANATION.

Thumb.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. Section of the superficial layer of the aponeurosis.
D. Deep layer of the superficial aponeurosis.
E′. Tendon of the extensor of the thumb seen through the aponeurosis.
F. The nail.

1. Dorsal artery.
2, 3. Branches furnished by the digital arteries.
4. Dorsal nerve of the thumb.
5. Terminal branches of the digital nerve.

Index Finger.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue.
C. Interdigital fibres of the palmar aponeurosis going to be inserted into the under surface of the skin.
D. Superficial aponeurosis of the dorsal surface of the index finger bounding the extensor tendons.

1. Dorsal artery of the index finger.
2. Dorsal artery of the index finger.
3, 4. Branches of the digital arteries passing to the dorsal surface of the index finger opposite each phalanx.
5, 6. Dorsal veins.
7. External dorsal nerve.
8. Internal dorsal nerve.
9, 10, 11, 12. Terminal branches of the digital nerves.

Middle Finger.

A. Section of the skin.
B. Section of the subcutaneous cellular tissue.
C. Root of the nail and dermal layer beneath the nail.
D. Superficial aponeurosis.

1, 2, 3. Venous network on the dorsal surface.

Ring Finger.

A. Section of the skin.
B. Section of the subcutaneous fascia.
C. Dermal layer beneath the nail divided to show the dorsal surface of the ungueal phalanx.
D. Articulation between the second and third phalanges together with the dorsal ligament.
E. Articulation between the first and second phalanges.
F. Tendinous dorsal fibres of the lumbricales muscles.
G. Tendinous dorsal fibres of the lumbricales and interosseous muscles.
H. Articulation between the first phalanx and the metacarpus.

Little Finger.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Dorsal surface of the third phalanx.
D. Articulation and dorsal ligament of the second and third phalanges.
E. Second phalanx.
F. First phalanx.
G. Section of the extensor tendons of the little finger.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

We shall not speak of each finger separately, but apply our observations to the fingers in general.

Wounds of the dorsal surface of the fingers are very frequent, and they are of all kinds; they vary also as to their extent and depth. Their frequency is readily explained by the numerous uses to which the hand is applied, and more especially by the number of the fingers. These wounds may involve the skin, the subcutaneous cellular tissue, the aponeurotic tissues, the tendons of the extensor muscles, the bones, or the articulations. Wounds which are confined to the skin are of little importance, they heal up rapidly, and often by the first intention. Those which extend to the cellular tissue are sometimes accompanied by a considerable amount of separation of the parts; if they are produced by a cutting instrument, they heal up all the same without further complication, either by the primary or secondary intention. Wounds which pass beyond this layer necessarily divide the venous network, which is very minute and gives rise to a considerable hæmorrhage, the hæmorrhage is more abundant in proportion as the wound is situated nearer to the roots of the fingers where arteries and veins of a tolerable size are present in large numbers.

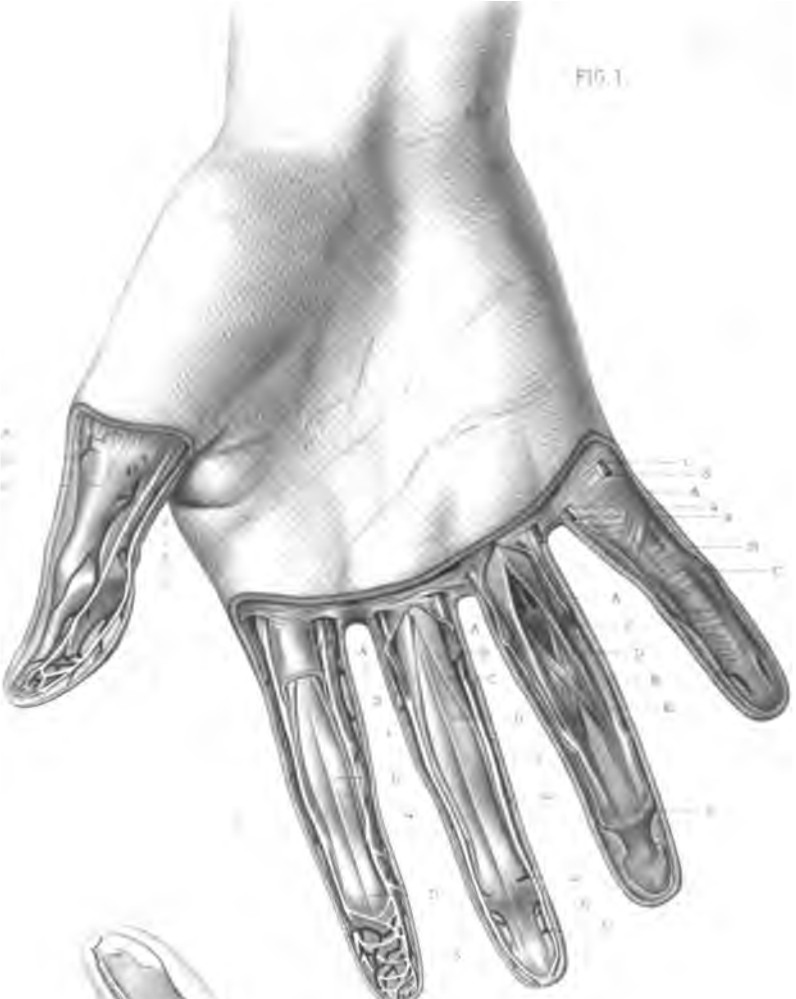
In passing deeper, a resisting fibrous sheath is met with formed of its proper fibres and of fibres coming from the palmar aponeurosis and the tendons of the lumbricales muscles. This sheath is, moreover, very thick. If it is only cut or penetrated, the wound of the subjacent soft parts will heal equally well, but if it is a contused wound, the tendinous fibres may mortify and render the work of cicatrisation very tedious. If the tendon is injured by a cutting instrument, its retraction is not great in consequence of the fibres which unite it to the phalanges, and it will not be necessary, as in the case of the dorsal surface of the hand, to apply a suture to the divided tendons. Very often the violence is so great that the bones are involved or the articulations laid open. In these cases the bone may be separated or fractured; if the bone is not separated the cicatrisation may take place without any impediment. Sometimes one of the phalanges is broken by external violence.

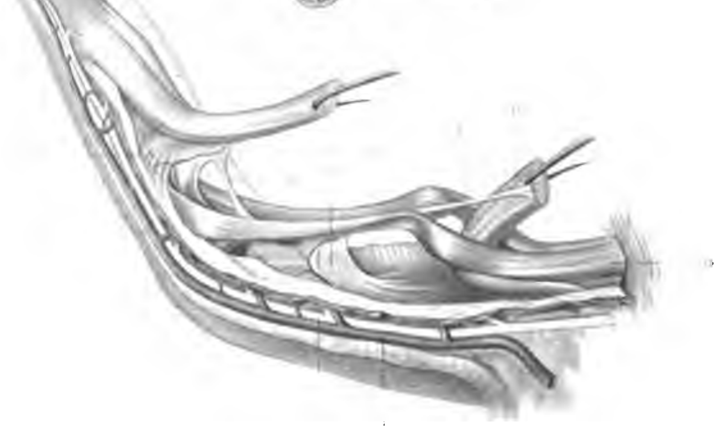
Inflammation of the dorsal surface may occupy: 1. the skin, 2. the subcutaneous cellular tissue, 3. the sheath of the tendons, 4. the tendons, 5. the periosteum, 6. the bones, 7. the articulations.

Inflammation of the skin may present several varieties; we shall point out the two principal, which are spoken of under the name of onychia maligna (*panaris anthracoide*) when situated in the numerous follicles of the region, and under that of paronychia when it is situated at the root of the nail. In the other tissues, the inflammation presents no distinctive character.

Organic diseases often occur on the dorsal surfaces of the fingers; amongst these may be mentioned enchondroma, white swelling, osteosarcoma and spina-ventosa. In regard to operative surgery, we may observe that numerous operations are performed upon the fingers, and amongst others their disarticulation. In these cases, the surgeon obtains important information from an examination of the folds on the dorsal surface of the fingers. The thinness of the soft parts on the dorsal surface of the fingers explains why the surgeon prefers making a flap from the palmar surface.

FIG. 1.





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LIBRAIRIE GERMER BAILLIÈRE

PLATE LXXXIX.

FIGURE 1.—Digital Region

Palmar surface.

EXPLANATION.

Thumb.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fascia.
C. First phalanx of the thumb covered by its periosteum.

1, 2. Branches of the princeps pollicis artery passing along the sides of the thumb.
3, 4. Digital nerves
5. Net work of nerves at the extremity of the thumb.

Index Finger.

A. Section of the skin.
B. Section of the fatty subcutaneous cellular tissue.
C. Fibro-synovial sheath of the flexor tendons of the index finger.
D. Tendon of the deep flexor become superficial after having passed through the tendon of the flexor sublimis.

1. Internal digital artery.
2. External digital artery.
3. Arterial network.
4. Internal digital nerve.
5. External digital nerve.

Middle Finger.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Tendon of the superficial and deep extensors contained in their sheath which is laid open.
E. Insertion of the tendon of the deep flexor.

1. Internal digital artery.
2, 3. Subcutaneous branches coming from the internal digital artery.
4. Internal digital artery.

Ring Finger.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the fibro-synovial sheath of the flexor tendons.
D. Tendon of the superficial flexor muscle.
E. Insertions of the superficial flexor muscle.
F. Anterior insertions of the superficial flexor muscles.

Little Finger.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Posterior surface of the fibro-synovial sheath widely opened.

1, 3. Internal digital artery and nerve.
2, 4. External digital artery and nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate facilitates the understanding of the divisions that have been established with regard to inflammation of the fingers that is to say of *paronychia*. But we will first say a few words upon the mechanical lesions of these organs.

From the various uses to which they are applied, and from their number, the fingers are often wounded. Wounds from pointed, cutting and bruising instruments often happen to the fingers.

All these wounds vary as to their situation, and their complications. Wounds from pointed instruments are generally devoid of danger and without complications. Nevertheless, if the instrument is poisoned as in dissection wounds, if the wound is not carefully attended to dangerous consequences may ensue, such as phlebitis, inflammation of the lymphatics, phlegmonous inflammation and erysipelas. These complications are easily explained by the presence of numerous net-works of veins and lymphatics.

Wounds which are situated on the sides of the fingers are mostly followed by hæmorrhage in consequence of the digital arteries being divided. Wounds from crushing are very frequent, because the fingers are easily entangled in machinary or between other bodies. These wounds may be treated advantageously by cold irrigations.

Lacerated wounds of the fingers are very common. These wounds are accompanied by laceration of the tendon of which we shall speak hereafter.

While handling a sharp instrument a person is liable to wound himself, and it has sometimes happened that a portion has been completely separated. The reunion of the separated portion when replaced, succeeds here more than elsewhere. This success is accounted for by the number of vessels and nerves with which the tissues are supplied.

With regard to inflammation, the divisions of it which have been established are justified by the difference in the tissues it may attack. Inflammation may be seated in: 1. the skin; 2. the subcutaneous cellular tissue; 3. the synovial sheath of the tendons; 4. the periosteum; 5. the bone; 6. the articulations.

With regard to organic lesions, we may mention fibrous tumours, fatty tumours, cysts, warts, white swelling, diseases of the bones, such as caries, osteitis, or necrosis.

FIGURE 2.—**Sheath and Arrangement of the Flexor Tendons.**

EXPLANATION.

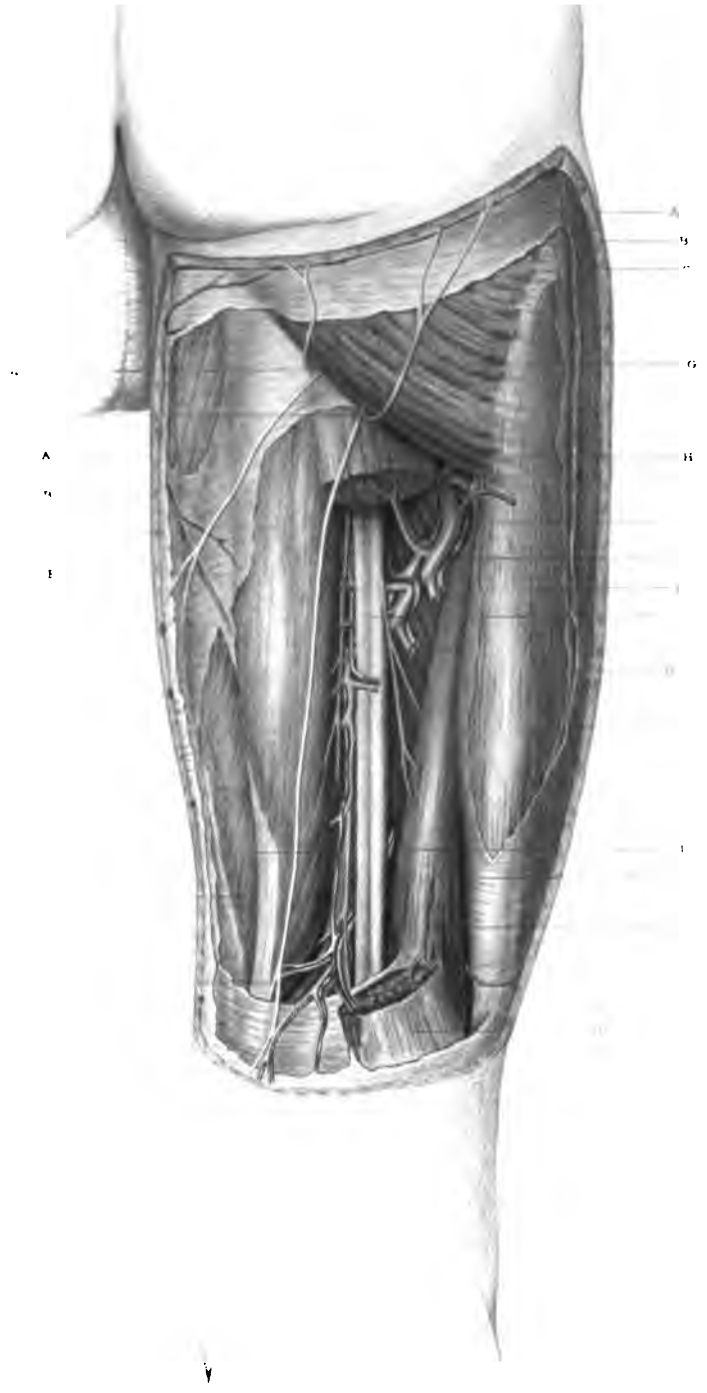
A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the fibro-synovial sheath laid open to show the arrangement of the tendons of the flexor muscles of the fingers.
D. Tendon of the deep flexor of the fingers.
D′. Section of the same tendon.
E. Sheath of the tendon of the superficial flexor, receiving the tendon of the deep flexor.
E″. Expansion of the synovial membrane on the tendon of the superficial flexor conveying an artery on to the tendon. It is a kind of mesentery or *meso-tendon.*
F. Meso-tendon or tendon of the deep flexor.
F″. Another small meso-tendon.
G. Tendon of the superficial flexor.

1. Digital artery.
2. Digital nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

We shall mention two facts in reference to this figure. The first is the presence of meso-tendons, in the thickness of which there is an artery and veins which provide for the nutrition of these fibrous bands. It is certainly owing to the presence of these vessels that the tendons are enabled to resist the causes of mortification, when there is inflammation of the sheath of the tendons or of the tendons themselves.

The second fact is one that relates to lacerated wounds. The two tendons, as is seen, are attached to the two last phalanges of the fingers. When the second, and still more when the third phalanx is torn away, the tendon is also acted on at the same time as the bone. But the tendons resist, and if the bone is actually detached, the rupture of the tendon will occur at its junction with the muscular fibres; and then there comes out with the bone a long tendon which gives a strange appearance to the portion that is torn away, as in a case mentioned in the *Mémoires de l'Académie de Chirurgie.* The portion of the tendon that is torn away varies in length, and if the wound passes high up, the danger will be in proportion to its height. If the tendon is divided below the synovial sheath of the wrist the wound is not dangerous; if, on the contrary, the laceration is opposite or above this sheath, then the danger is very considerable.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE CXI.

Femoral Region.

Posterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue.
C. Section of the superficial or investing aponeurosis.
D. Section of the aponeurosis proper of the semi-membranosus muscle.
E. Special aponeurosis of the semi-tendinosus, sartorius, and internal rectus muscles and of the long portion of the biceps.
F. Semi-membranosus muscle.
G. The lowermost fibres of the glutæus maximus muscle inserted below the great trochanter.
H. Section of the long portion of the biceps.
H′. Section of the inferior portion of the biceps at its junction with the short portion.
H″. Small or short portion of the biceps.
I. Rectus internus muscle.
J. Semi-tendinosus muscle.

1. The profunda femoris artery after its passage through the ring of the adductors.
1′. Branches from the femoral which gives them off during its course in front of the tendon of the third adductor, they are distributed to the skin and to the lower part of the muscles bounding the popliteal space above.
1″. Small artery also from the femoral distributed to the two portions of the biceps muscle and anastomosing with the preceding artery.
2. Vein accompanying the profunda femoris artery.
3. Sciatic nerve.
4. Branch of the small sciatic nerve.
5. Second branch of the small sciatic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

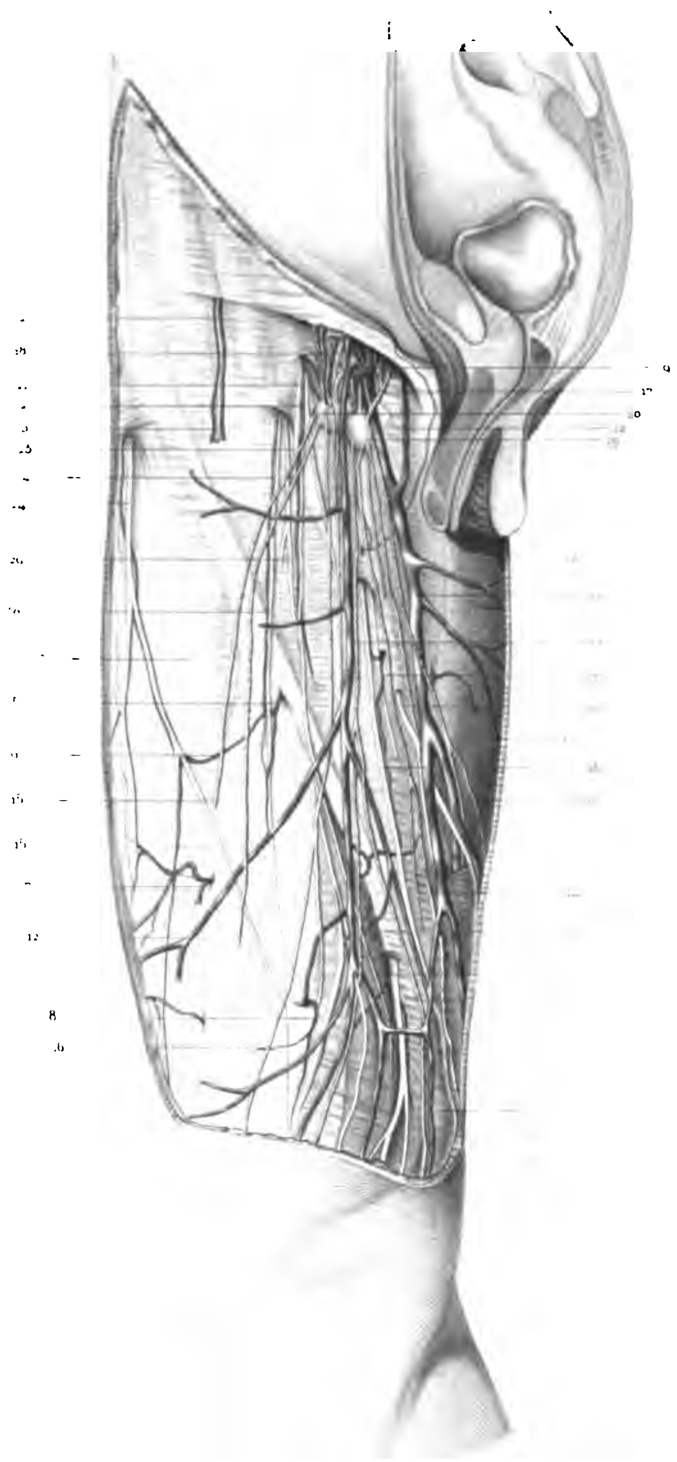
The physical lesions of this region are not dangerous to life even when they are deep seated. The latter can, in fact, hardly do more than reach the sciatic nerve, or some of the branches of the profunda femoris artery. A wound of the sciatic nerve is rare, in consequence of the depth at which the nerve is placed. Still more must this be the case with regard to wounds of the branches of the profunda femoris artery. Moreover, both these organs are protected by powerful masses of muscles; behind, by the long portion of the biceps muscle; above, by the inferior border of the glutæus maximus muscle; internally, by the tendinous expansion formed by the tendons of the sartorius, gracilis, and semi-tendinosus muscles; externally, by the semi-membranosus muscle, the short portion of the biceps, and higher up by the long portion of the same muscle.

Vital lesions, such as inflammations, abscesses, &c, present the same characters here as in the gluteal region. Those which are superficial do not call for any special remark. Those which are deep seated or sub-aponeurotic present, on the contrary, special characters, which are evident from a simple examination of the region. The intermuscular space which is traversed from above downwards by the sciatic nerve, encloses a large quantity of cellular tissue; hence the possibility of the occurrence of inflammation and abscesses. This inflammation and these abscesses may be local, and this is the most favourable condition. But the intermuscular canal communicates freely above with the glutæal region, and below with the popliteal space. It follows from this arrangement of the parts, that the inflammation and the suppuration has a great tendency to extend to the neighbouring regions. Hence the precept to make a speedy opening for the exit of pus, and to treat energetically any inflammation arising in this part. This disposition of the part also allows the opposite result to ensue. Thus, a chronic or acute abscess occupying the gluteal region will very probably extend into the present region. It is the same with regard to an abscess in the popliteal space. This development of abscesses coming from above is so far in the natural course of events that very often the surgeon only recognises the presence of the abscess when it has extended into the posterior region of the thigh.

Abscesses from congestion arising from caries, from affection of the nerves, or from tuberculous disease of the anterior surface of the sacrum, as I have recently seen in the case of a young boy, follow the course of the sciatic nerve, and so pass out of the pelvis to occupy the gluteal region, and at a later period the region of the thigh. When these abscesses are still covered by the glutæus maximus, they are not generally perceived, and as they give rise to acute pain in the course of the sciatic nerve, the most skilful surgeon may be led into error and merely suppose there is sciatica when in reality another serious disorder is present.

A disorder peculiar to this region is neuralgia of the sciatic nerve. This disease shows itself by pain in the course of the nerve, which the patient is able to trace very clearly with his finger, although he is ignorant of the direction of the nerve. The pain is excited by pressure, and is more acute in proportion as it is situated near a point where branches are given off.

Organic lesions are rare; nevertheless, we meet with fistulæ, caries, fractures, cysts, and neuromas, all of which are accounted for by the presence of the femur and of the sciatic nerve. The skin is sometimes destroyed by burns, giving rise to contractions of the limb which no treatment will modify. The more curious disorders of the region are fibro-plastic tumours, encephaloid tumours, and myeloid tumours, which arise from the femur. The presence of fibro-plastic tumours is explained by the large quantity of fibrous tissue which is met with in the region. We saw a patient under the care of M. Velpeau, in 1850, who had one of these tumours situated between the internal and external muscles of the region. The tumour had been several times removed, but it always returned, and ultimately the patient succumbed to the disease. The operations which are performed in this part of the body are rare. We shall not speak of fractures, and shall only mention the dividing of bands, produced by burns, and the incision of the muscles when a white swelling has terminated in a permanent displacement of the tibia backwards. We shall not dwell upon these operations, because they are not much used, and, moreover, the latter is advantageously replaced in the present day by section of the tendons, and especially by the method of Palasciano of Naples. This plan consists in reducing the limb, not by direct extension, but by a flexion, still more excessive than that which already exists. When by this means the adhesions of the extensor muscles of the limb have been destroyed, forced extension is suddenly performed. By this means the knee is restored almost to its normal position. We say almost, because the extension never returns to its normal limits; and this probably arises from several causes, of which the most important appears to us to be the shortening which has taken place in the lateral ligaments. We propose to divide these ligaments by a subcutaneous incision, so as to completely restore the tibia to its relations with the femur. Perhaps we might also have to divide the inter-articular ligaments.



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LIBRAIRIE GERMER BAILLIERE

PLATE XCII.

Femoral Region.

Anterior surface, superficial layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia and of the subcutaneous cellular tissue.
C. Superficial femoral aponeurosis or envelope.

1. The anastomotica magna artery coming from the femoral.
2. The superficial epigastric artery given off by the femoral artery at its crural portion.
3. Superficial artery, a branch of the circumflex iliac.
4. Another superficial artery furnished by the femoral.
5. Another arterial branch coming from the femoral.
6. Subcutaneous anastomosis between the ramifications of the femoral.
7. Another superficial branch of the femoral forming anastomoses.
7′. Small subcutaneous artery anastomosing with other branches of the femoral.
8. Inferior arterial branches of the femoral artery forming anastomotic arches with the superior branches and with other branches situated below.
9. Artery of the abdominal integument.
10. Internal saphena vein.
11. Internal accessory saphena vein, or collateral vein of the internal saphena.
12. External pudic vein going to join the internal saphena vein.
13. Branch of the vein going to join the internal saphena vein.
14, 14. Internal lymphatic vessels.
15, 15. External lymphatic vessels.
16. Middle lymphatic vessel.
17. Lymphatic vessels coming from the external genital organs.
18. Lymphatic vessels coming from the abdominal wall.
19. Internal and inferior lymphatic gland.
20. Internal lymphatic gland.
21. Cutaneous branches of the external inguinal nerve.
22. Cutaneous branch of the hypogastric nerve.
23. Cutaneous branches of the crural nerve.
24. External cutaneous branch.
25. Cutaneous branches of the crural nerve.
26. Internal saphena nerve.
27. Other branches of the crural nerve.
28. Internal perforating branch of the crural nerve.
29. Perforating cutaneous filaments of the crural nerve.
30. Cutaneous filaments of the crural nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The applications we are about to make refer only to the tissues included between the skin and the superficial aponeurosis. The physical lesions which affect these tissues cannot be very important, but, nevertheless, they are still deserving of attention. Wounds and contusions of the skin present no special characters. Thus, whether they are caused by a pointed, a cutting, or a bruising instrument, they behave here as in all the other regions of the body. It is the same, also, if they extend to the subcutaneous cellular tissue. But if these injuries extend deeper, they encounter the veins and lymphatics, and then they give rise to serious disorders. Amongst the physical lesions which belong to the subcutaneous cellular tissue, we may mention traumatic separation of the skin, followed by serous or sanguineo-serous effusion, which were seen and described for the first time with so much truth and ability by M. Morel-Lavallée, surgeon to the Hôpital Beaujon. The whole region is covered with veins which are of considerable size in their normal condition, but which, under certain conditions, such as compression or inflammation, sometimes acquire an enormous size, so as to form true vascular tumours. A wound may reach these veins, and would present a certain amount of danger, because of the hæmorrhage or the phlebitis which would almost inevitably follow. In consequence of the superficial situation of these veins, it will always be easy to know whether the blood comes from them or from the femoral artery, if the surgeon had not already other means, such as compression above and below the wound, the colour of the blood, &c., of establishing a positive diagnosis. This superficial situation, as well as the direction of the veins (veins or branches of the saphena), also enables us easily to ascertain the existence of phlebitis by the presence of a hard, painful cord, projecting beneath the skin.

The lymphatic vessels are numerous and often wounded; but they are very small, so that they do not give rise to any apparent discharge, and their wounds often pass unnoticed. In certain conditions of climate, such as that of the Isle of Bourbon, these vessels attain a great size, and if they are wounded they discharge such a quantity of lymph as becomes serious. This was the case in an inhabitant of the Isle of Maurice, seen by M. Gubler, who lost such a quantity of the fluid that sufficient was collected for making several analyses of it These cases of lymphatic varices and hæmorrhage had already been pointed out by M. Beau, and recorded in the thesis of M. Binet.

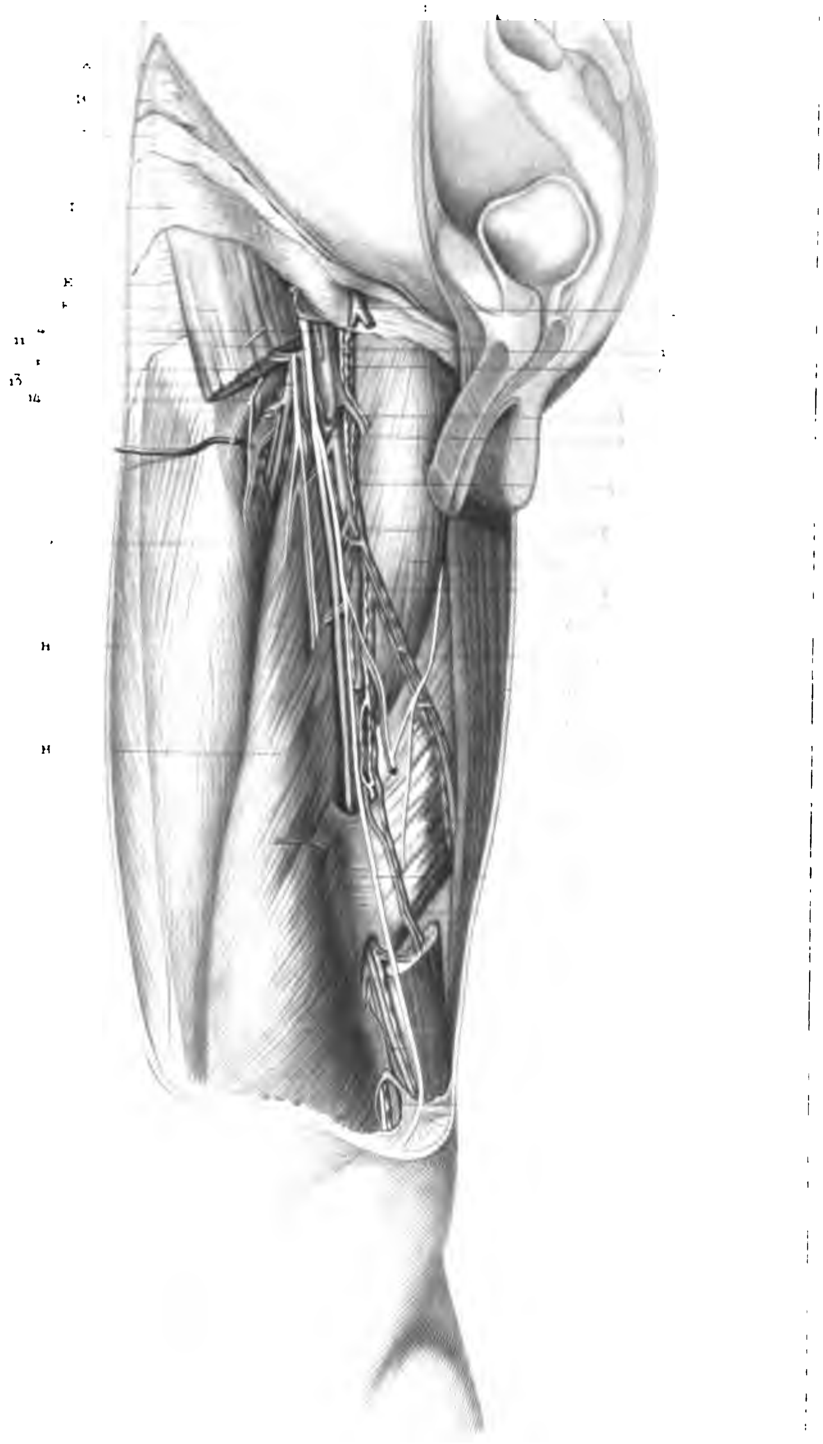
Wounds of the nerves will seldom give rise to general disturbance. But we can understand that in hot climates, notwithstanding their harmless character, they may occasionally be followed by tetanus. Wounds of the subcutaneous arteries are not followed by hæmorrhage, because they are not of sufficient size. It is these small arteries which dilate more and more after the femoral has been ligatured in the groin, and which are felt pulsating beneath the skin. If after this dilitation it was necessary to amputate the thigh, it would certainly be necessary to tie some of these vessels to prevent hæmorrhage.

Vital lesions are frequent. We shall notice phlegmon and abcesses. The order of succession of the different layers is as follows: 1. the skin; 2. the subcutaneous fatty tissue; 3. the superficial layer of the superficial fascia; 4. the adipose layer in which is found the vessels and subcutaneous nerves; 5. the deep layer of the superficial fascia; 6. the superficial aponeurosis or envelope. It may happen that the inflammation is confined between each of these six layers, and then we have the following varieties of inflammation: 1. a subcutaneous inflammation situated between the skin and the first layer of the superficial fascia; 2. an inflammation situated between the two layers of the superficial fascia; 3. an inflammation situated between the deep layer of this fascia and the aponeurosis. Hence there are three kinds of inflammation to which may be added the inflammation which attacks the two layers of the fascia themselves. Abcesses present the same characters as regards their situation. Abcesses from congestion occur most frequently at the upper part of the region. They are generally connected with disease of the vertebral column, and pass out of the pelvis either by following the course of the crural canal, or the sheath of the psoas muscle. These should be carefully considered, because they cover the femoral artery in front, and if we wished to open them we might wound that vessel and so add a serious complication, in a state already sufficiently dangerous.

Organic lesions are somewhat frequent. We may instance fatty and fibrous tumours, cysts, varices, glandular tumours, and cancer.

Amongst the various tumours whose presence may be explained by a simple inspection of the region, as well as by their general and specific characters, we shall only refer to glandular tumours. It is well known that M. Richard, surgeon to the Hôpital Cochin has long since proved that the spaces which are met with in glands may, by continuous dilitation, at length convert the gland into a serous or sero-lactescent cyst, or even into a sanguineous cyst. We do not refer to these tumours, but to those which attack the lymphatic vessels and the glands at the same time. When the glands are thus dilated, or become in a manner aneurismal, they form tolerably large tumours at the upper part of the thigh; these tumours are irregular, nodulated, hard in some parts, soft and fluctuating in others, they occur in the form of varices in the inhabitants of the Isle of Bourbon and in the neighbouring islands.

There are but few special operations performed in this layer of the region. In the removal of the tumours we have just described, there is hardly any reason to expect hæmorrhage. It has, however, been proposed to divide the fibrous arch through which the internal saphena passes to join the femoral vein. It has been maintained that the dividing of this fibrous band would have the effect of relieving the compression which it has been supposed to exercise upon the saphena vein, and so remedy the varicose condition of the vein which was the result of this compression. This view is altogether imaginary, nor do we think that the operation will ever be generally practised.



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LIBRAIRIE GERMER BAILLIERE

PLATE XCIII.

Femoral Region.

Second layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue.
C. Section of the superficial fascia.
D. Section of the femoral aponeurosis at its upper part.
E. Deep layer of the femoral aponeurosis.
F. The sartorius muscle divided to show the femoral vessels.
F′. The sartorius muscle divided at its lower part.
G. Rectus femoris muscle.
H. Vastus externus muscle.
H′. Vastus internus muscle.
I. Gracilis muscle.
J. The adductor longus and brevis muscles.
K. Adductor magnus forming the fibrous ring through which the femoral artery passes to reach the popliteal space.

1. Femoral artery passing out of the crural canal.
2. Femoral artery at its middle part.
2′. Superior internal articular artery.
3. Artery of the adductor muscles of the thigh.
4. Artery of the inguinal glands.
5. Arterial branches for the rectus femoris and triceps muscles.
6. Arterial branch for the gracilis muscle.
7. Arterial branch for the sartorius muscle.
7′. Cutaneous and muscular branch passing out by the same fibrous orifice with a vein and a nerve.
8. Muscular branches for the vastus externus and the adductor muscles.
9, 9. Veins accompanying the femoral artery.
9′. Veins accompanying the femoral artery on its outer side
10. Vein of the abdominal integument.
11. Perforating branch of the crural nerve.
12. Cutaneous branch of the crural nerve.
13. Muscular branches of the crural nerve.
14. Branches of the crural nerve going to the anterior rectus of the thigh.
15. Anastomosis of the obturator with the crural nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In this Plate we have to treat of the surgical applications of all the organs included between the superficial aponeurosis and the femur.

Wounds which pass beyond the aponeurosis, if they are situated externally, or quite internally, and especially if they are not oblique, involve but little else than the muscles or the femur. In this respect they possess no special character. But if these wounds produced by pointed, cutting, or bruising instruments are situated in the course of an imaginary line passing from the middle of the groin to the inner part of the internal condyle of the femur, they are very dangerous, because they are almost certain to reach the nerve, the artery, or the vein which traverse the region throughout nearly the whole of its extent. By its immediate division into several small branches, the crural nerve seems to escape, so to speak, the dangerous consequences arising from injury to a large nerve. The wound, in fact, must be long, deep, and transverse, in order that all its branches should be implicated at the same time. This accounts for the fact that deep wounds of the anterior region of the thigh are seldom followed by paralysis and loss of sensation in several organs at the same time.

As regards the artery, injury of it occurs much more easily. It would appear that its situation above, where it is, so to speak, on a level with the skin, as well as its situation in the middle and lower part of the thigh, bring it in the way of any weapon. Add to this anatomical condition, that physiological peculiarity which instinctively impels us, in spite of ourselves, to bring the thighs together when we wish to prevent anything falling to the ground that we have in our hand, and you have an explanation of the frequent occurrence of these wounds. To remedy this injury the surgeon possesses styptics, and more especially the ligature, applied either at the seat of the wound or above it.

Injury of the femoral vein, which is very serious above the entrance of the saphena vein, but less dangerous below it, may occur alone, or it may be accompanied by injury to the artery or other organs. Arterial or arterio-venous aneurism is frequently a consequence of these wounds.

All the muscles of the thigh may be wounded, or torn completely or partially in consequence of contusions, wounds, or violent efforts. The rectus femoris is the muscle to which this accident most frequently occurs. Lastly, we may mention amongst the physical lesions belonging to this region, fractures of the femur.

The most frequent of the vital lesions are inflammations and abscesses. It is sufficient to consider the different layers of the region to infer at once what varieties are to be admitted as regards their situation.

The organic lesions which specially deserve our attention are aneurisms and the effusion of blood which precede them. These aneurisms may be situated at any part in the course of the artery. It is on account of these aneurisms that ligature of the femoral artery is most frequently performed.

A ligature may be applied at three places: 1. above; 2. at the middle; 3. below.

Above, the ligature may be applied to the artery, either below the femoral arch, or at the apex of the triangle of Scarpa. We shall only speak of the application of the ligature at the apex of this triangle. The vessel is seen to be superficial just above the sartorius muscle. On consulting this Plate and the preceding, we may perceive that in order to reach the artery it is necessary to divide successively: 1. the skin; 2. the cutaneous fatty tissue; 3. the two layers of the superficial fascia, between which there are several organs, and amongst them glands which must be pushed on one side; 4. the superficial aponeurosis. To understand the situation of the artery it is sufficient to remember that it is placed between the nerve and the vein.

At its middle part the artery is placed deeper; it is separated from the superficial aponeurosis by the entire thickness of the sartorius muscle. To expose the vessel it is necessary to pass through the same layers as in the application of the preceding ligature, and the sartorius muscle must be taken as the guide. When this muscle is reached, the question arises whether it should be divided in the direction of its fibres, or whether it should be pushed aside. Everyone is agreed to adopt the displacement of the muscle. Should this be done inwards or outwards? Based upon a long experience, we have always turned the muscle inwards when teaching our pupils operations. When the muscle is removed the artery is seen beneath the second layer of the aponeurosis. The aponeurosis is to be opened by a series of oblique cuts and the ligature applied.

With regard to ligaturing the femoral artery opposite the ring formed by the third adductor muscle, it presents serious difficulties. The proceedings are the same as in the former cases, until the sartorius muscle is reached, which is here also the principal guide. The superficial aponeurosis is divided, and the fibres of the sartorius muscle laid bare; their direction enabling them to be readily distinguished from those of the vastus internus, the muscle which is next to them. The sartorius is pushed towards the inside. This enables the operator to see the condyloid portion of the third adductor muscle which forms a projection; the second guiding point is then to be sought, namely, the saphena nerve, which passes out of the sheath of the femoral artery by a well-defined fibrous arch. It may be said that having reached the nerve we have also reached the artery, for it is sufficient to introduce a grooved director through this fibrous opening, in order to divide the fibrous tissue in front, and thus expose the femoral artery. The separation of the artery from the vein or veins which accompany it is sometimes difficult; for this reason it is necessary to proceed with care in order to avoid wounding either vessel. In this way we prevent both venous hæmorrhage and phlebitis.

FIG 1

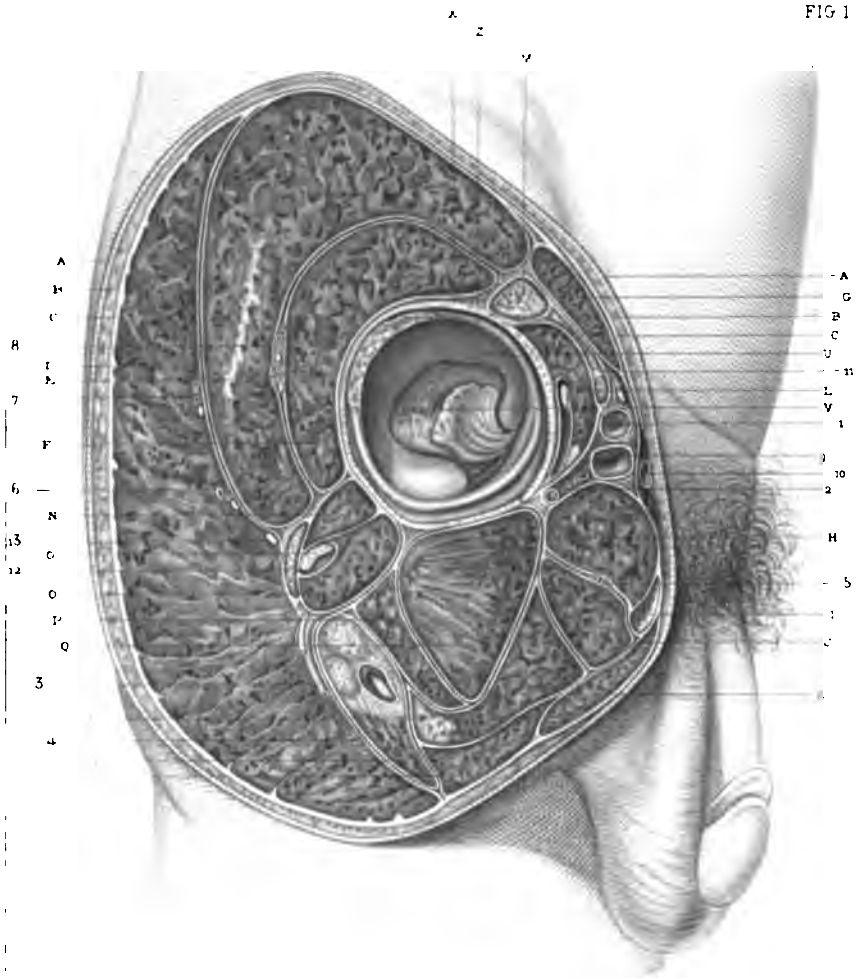
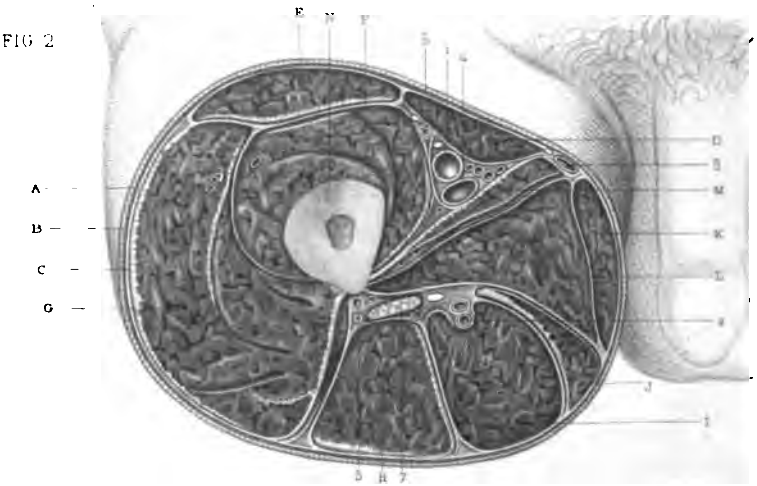


FIG 2



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XCIV.

FIGURE 1.—Inguinal and Gluteal Regions.

Transverse section of the two regions

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the superficial aponeurosis or envelope.
D. Section of the glutæus maximus muscle.
E. Section of the glutæus medius muscle.
F. Section of the glutæus minimus muscle.
G. Section of the sartorius muscle.
H. Section of the gracilis muscle.
I. Section of the adductor brevis femoris muscle.
J. Section of the semi-tendinosus muscle.
K. Section of the adductor longus femoris muscle.
L. Section of the psoas and iliacus muscles.
M. Section of the tendon of the rectus femoris muscle.
N. Section of the pyramidalis muscle.
O. Section of the gemellus superior and inferior muscles.
O′. Section of the tendon of the obturator internus muscle.
P. Section of the long portion of the biceps muscle.
Q. Section of the semi-membranosus muscle.
R. Section of the obturator externus muscle.
S. Section of the adductor magnus muscle.
T. Section of the quadratus femoris muscle.
U. Cotyloid cavity.
V. Base of the cotyloid cavity with its adipose tissue.
X. Section of the capsule of the hip-joint.
Z. Margin of the cotyloid cavity.

1. Section of the femoral artery.
2. Section of the profunda femoris artery.
3. Section of the sciatic artery.
4. Section of the arteries and veins which go to the glutæus maximus muscle.
5. Section of the vessels which are distributed to the adductor muscles.
6. Section of the arteries, veins, and nerves of the glutæus maximus muscle.
7. Section of the vessels and nerves which are distributed to the upper part of the glutæus maximus muscle.
8. Vessels and nerves distributed to the glutæus medius and minimus muscles.
9. Section of the femoral vein.
10. Section of the internal saphena vein.
11. Section of the crural nerve.
12. Section of the sciatic nerve.
13. Section of the small sciatic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Figure 1 of the present Plate supplies us with the information required for the disarticulation of the hip-joint. In this respect, it can be seen at once that the articulation is nearest the skin on its inner side, and that, therefore, it is best to open the articulation from this side. In proceeding in this way, it is true that we at once divide the large vessels and have a very profuse hæmorrhage, but nothing is easier than to remedy this accident at once by applying a ligature to the femoral artery. This having been done, the disarticulation can be proceeded with. It must be admitted that in resection of the head of the femur, an operation in which we carefully endeavour to avoid important organs, such as the artery, we should not be justified in acting in this way. It is for this reason that in this operation, the articulation is reached from the gluteal region. Let us, however, return to the subject of the disarticulation of the hip-joint. When we make use of an anterior flap, it is necessary that the vessels should be included in the flap; but, on looking at Figure 1, it is seen that the mass of vessels corresponds to the horizontal diameter of the articulation. It follows, therefore, that if we give the knife a horizontal direction after it has passed behind the vessels, we shall bring it against the head of the femur. To avoid this inconvenience, while retaining the advantage of passing it behind the femoral artery, it is necessary to raise up with the left hand the whole of the fleshy mass in front of the articulation, and to make the point of the knife describe the arc of a circle so as to pass round the superior segment of the articulation. Without saying that the point of the knife should only emerge at the termination of the horizontal line passing through the cotyloid cavity, it passes in such a direction as to divide it into two equal parts. It is only by observing these rules that the anterior flap can be made to include the artery, and to possess sufficient substance to cover the wound. As soon as the artery is included in the flap, an assistant can immediately arrest the flow of blood by directly compressing the artery between his fingers. This proceeding, which can be easily and quickly performed, enables the surgeon to continue the operation, and to save his patient much pain.

As soon as ever the disarticulation is accomplished, the ligaturing of the vessels should be immediately performed. The section we have given represents these vessels, and exhibits the order in which they should be tied, according to their size and importance.

The largest of these vessels is the femoral artery. It is with this that we should commence. It will be found at the inner part and on the anterior surface of the flap, not divided transversely, but obliquely. This kind of section necessitates some degree of caution on the part of the surgeon, so as to be certain that the ligature includes the whole circumference of the vessel, and not merely the sloping portion of it.

Sometimes the femoral vein yields a large quantity of blood, especially when the respiration is impeded and the circulation disturbed, a function that is always somewhat affected by chloroform. Under these circumstances there should be no hesitation in applying a ligature to the vein itself.

When the end of the femoral artery is closed, the blood may continue to flow in its vicinity from the branches of the profunda femoris. We should then proceed to ligature all the trunks and all the branches coming from this artery.

In the next place we proceed to ligature the sciatic artery (3); then the branches of the gluteal artery (6, 7, 8); and lastly, some of the muscular branches are tied, such as those coming from the gluteal (4), or those furnished by the obturator artery.

FIGURE 2.—Femoral Region.

Transverse section towards the middle of the thigh.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the aponeurosis covering the thigh.
D. Section of the sartorius muscle.
E. Section of the rectus femoris muscle.
F. Section of the vastus internus muscle.
G. Section of the vastus externus muscle.
H. Section of the long portion of the biceps muscle.
I. Section of the semi-membranosus muscle.
J. Section of the semi-tendinosus muscle.
K. Section of the rectus internus muscle.
L. Section of the adductor muscles of the thigh.
M. Section of adductor brevis muscle.
N. Section of the femur.

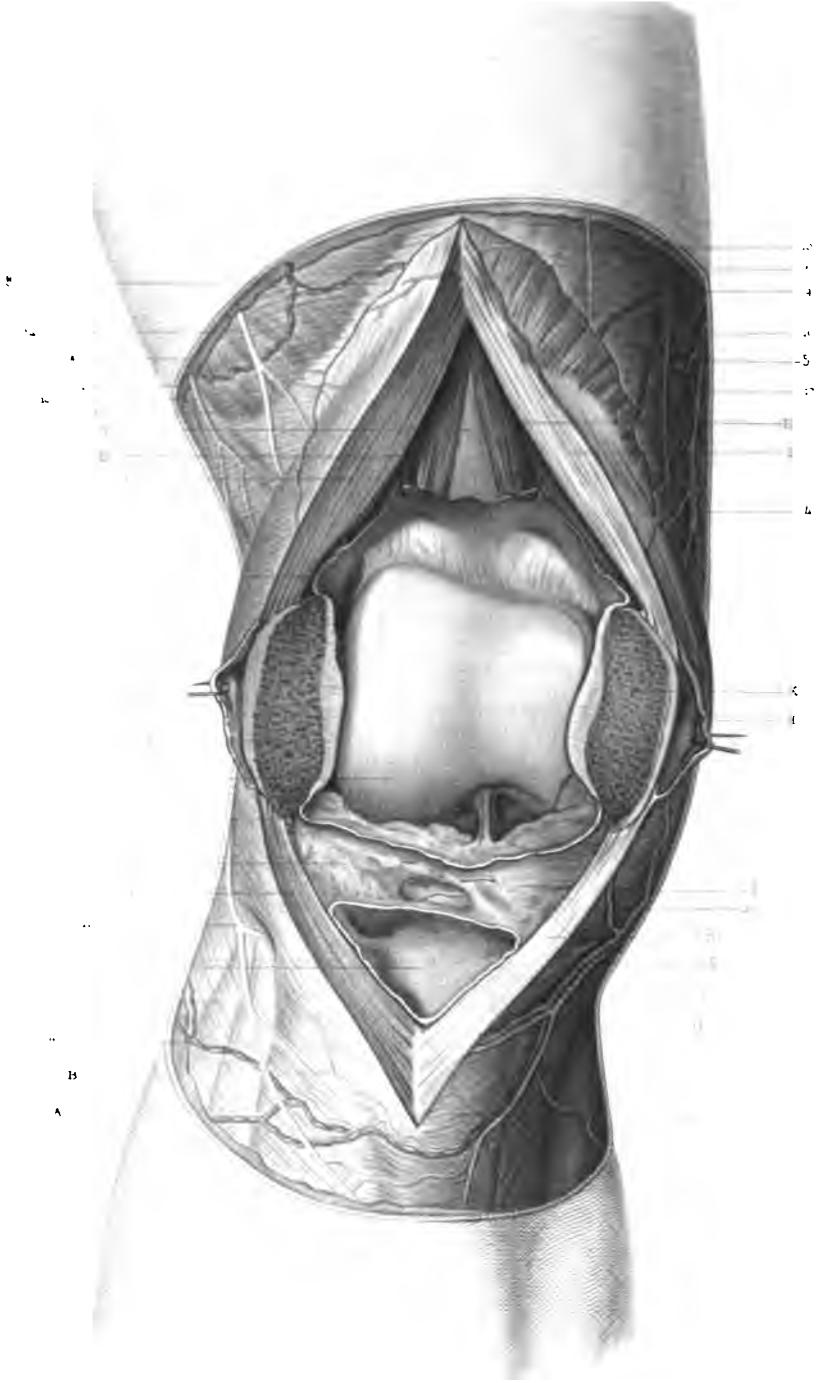
1. Section of the femoral artery.
2. Section of the profunda femoris artery.
3. Section of the sciatic artery.
4. Section of the femoral vein.
5. Section of the internal saphena vein.
6. Section of the superficial muscular arteries and veins.
7. Section of the sciatic nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In the present Figure we have in the first place to consider what relates to amputation of the thigh. There are two points to be investigated: 1. the necessity of preventing and arresting hæmorrhage; 2. the conditions which best enable us to cover the bone.

To prevent hæmorrhage, it is necessary to compress the femoral artery against the horizontal ramus of the pubis; but beyond this necessary and indispensable condition, there are also some other precautions to be taken for this purpose, and these precautions vary according to the mode of operating. If the circular method is adopted, the artery will be divided transversely, and will present a widely-opened orifice for the application of the ligature. But if the flap operation is performed, it is necessary to guard against an accident which may possibly happen. We see, for instance, that if only an anterior flap is made, the artery should be included in the thickness of the flap, care being taken to raise sufficient of the soft parts, so as to bring them in front of the femur. If we violate this rule, we run the risk of penetrating the artery, and of leaving its orifice included in the angle of the flap. If two lateral flaps are employed, the artery is exposed to still greater risks. Thus, in passing the knife from before backwards to form the internal flap, we may divide the artery near the base of the flap, or divide it very obliquely, extending for some distance. If in this case we only tie the free extremity of the divided artery, we certainly run the risk of a fatal hæmorrhage. It is on account of the possibility of this accident that we consider the operation by means of two flaps very unadvisable. It is scarcely necessary to enumerate the vessels that have to be tied in amputation of the thigh. It is sufficient to examine Figure 2 to see that they consist of three principal vessels and some muscular branches.

In order to cover the bone, surgeons have employed various means, and it is on this account that so many modes of operating have been proposed. The quadruple incision is that which is now mostly employed, and we are indebted to the lectures of M. Malgaigne for its general adoption. Thus, in order to have a sufficient amount of the soft structures, we divide, 1. the skin; 2. the muscles down to the bone; 3. the muscles which remain adhering; 4. we detach the muscles from the bone to the required extent; 5. we divide the bone close to the muscles previously drawn back by means of a compress.



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LIBRAIRIE GERMER BAILLIERE

PLATE XCV.

Region of the Knee.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Superficial aponeurosis.
D. Tendon of the patella.
D′. Vertical section of the tendon of the patella.
E. Section of the triceps muscle.
E′. Tensor muscle of the articular synovial membrane of the knee.
F. Lower portion of the femur.
G. Serous bursa beneath the tendon of the patella.
H. Serous bursa in front of the patella.
I. Section of the articular synovial membrane.
I′. Fatty mass situated on the synovial membrane.
J. Condyles of the femur covered with their cartilage.
K. Vertical section of the patella.

1. Internal inferior articular artery.
2, 3. Superior branches of the internal inferior articular artery.
4. Ramifications of the superior articular artery.
5. Ascending branches of superior articular artery.
6. Internal inferior articular vein.
7. Anastomoses of the inferior articular veins.
8. Superior external articular veins.
9, 10. Superior internal articular veins.
11. Cutaneous nerve coming from the sciatic nerve.
12. Cutaneous nerve coming from the crural nerve.
13, 14, 15, 16, 17. Cutaneous nerves distributed to the knee, coming from the sciatic, crural, and obturator nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Projecting, and always carried forwards in walking, the region of the knee is much exposed to contusions, wounds, and injuries of all kinds. Falls on the knee, which are of such frequent occurrence, produce the same results.

Wounds from pointed instruments are not generally dangerous, even when they are deep. Nevertheless, these wounds may become dangerous when they involve the serous bursæ in front of the patella, or of the tibia, and more especially the synovial membrane of the knee-joint. The surgeon frequently introduces a trochar or a fine needle into the articulation, and thus opens the synovial membrane, either for the purpose of evacuating a fluid and afterwards injecting the tincture of iodine, or for the removal of a foreign body. Under these circumstances the wound generally heals very well, but only when carefully attended to by the surgeon. In fact, if, after such a wound, the patient is not careful, and continues to use the joint, inflammation of a most dangerous character will be set up. Thus, in some cases, wounds produced by pointed instruments may give rise to serious results. Wounds from cutting instruments are more dangerous than the preceding, the other conditions being the same. Whatever may be the direction and depth of these wounds, there will always be a difficulty in obtaining union by the first intention, because of the freedom of motion belonging to the region. It is the opening of the joint which causes their danger. When these wounds are penetrating, as they are technically termed, a small quantity of synovial fluid comes away, and it is this discharge which affords a far better means of diagnosis than probing the wound. There is, however, a source of error against which we must be on our guard. Thus, if we suppose the bursa in front of the patella, or the one behind the tendon of the patella, to have been opened, a serous synovial fluid will be discharged, whose characters are similar to those of the synovial fluid coming from the joint. This will clearly give rise to some amount of uncertainty; but if we consider that the quantity of fluid will be greater in the case of the joint; that it will be more ropy, more unctious, and of a yellower colour: if, also, we consider that the wound is situated at a distance from the other serous cavities of the knee, the diagnosis will rest upon a secure foundation.

These wounds from cutting instruments may involve the muscles, tendons, ligaments, and the aponeuroses of the region; they may also include the bones themselves, such as the patella, the inferior extremity of the femur, or the superior extremity of the tibia. When they are transverse, they may divide transversely all the muscles above the joint, the anterior rectus, the vastus internus, and the vastus externus. They may also divide transversely the tendon of the patella and the patella itself. We can readily understand what should be done in the case of these wounds: the limb must be placed in a state of extension, so that the ends of the wound may be brought in apposition and unite by direct union. It is only under these conditions that the use of the limb will be preserved. Is the application of the suture necessary to bring about this fortunate result? We think not, and for this reason: the extension of the limb completely restores the contact of the two ends, and perfect rest will maintain them in this condition. Sutures could do no more, and would become an additional cause of inflammation, the very complication that we have most to fear under the circumstances.

Wounds from bruising instruments and lacerations from falls are very numerous. Like the former, they may be superficial or deep. Superficial wounds are seated in the skin, in the subcutaneous cellular tissue, and in the bursa in front of the patella. The latter alone require to be noticed. These contusions affecting the bursa in front of the patella act in two ways; sometimes rapidly, sometimes slowly. When the action is rapid, it may present two conditions: either the injury acts exclusively on the bursa, and then there is an immediate laceration of the vessels, and a more or less abundant effusion of blood; or there is at the same time a laceration of the skin, and the wound of the bursa communicates externally. In this case, the skin must have glided in front of the patella, become puckered up, more or less lacerated, and when the effect of the violence had ceased, returned to its natural position, covering like a curtain the surface of the bursa, which gives issue to a sanguineous, serous fluid. We lately had under our care a case of this kind, which healed up without any complication, care having been taken to insert lint, moistened with a solution of camphor in spirits of wine, into the bursa, in which we had induced suppuration. When these wounds are deep, they present great danger, because they are usually attended with a free opening into the articulation, and at the same time involve the bones. This is the kind of wound produced by fire-arms. The danger is so great, that very often amputation of the thigh or resection is the only means of saving the patient's life. There is, however, one favourable circumstance which presents itself in these wounds, and which we ought to mention. The bones forming the articulation are all very spongy, and when a ball strikes them, they do not splinter, but allow it to pass through with the greatest facility, so that these wounds are not complicated with spiculæ or sharp fragments, and the ball does not generally remain; these are circumstances which diminish their danger. During the time of the insurrection in June, 1848, we saw at the Hôpital des Cliniques, when acting as house-surgeon, a patient who had received a ball which had passed through the condyles of the femur transversely, without touching the articulation. On the same occasion we saw a man who had been struck by a ball in the middle of the patella; the latter had not splintered, but the ball had passed through it, and had left a wound which looked as if it had been made with a punch.

Firmly united together by powerful ligaments and muscles, the bones of the knee are not easily displaced; dislocations arising from wounds are rare, and it is sufficient to notice the arrangement of articular surfaces to understand that they will generally take place backwards. Wounds arising from laceration of the articulation have not been noticed. When the body was drawn in quarters, we know that it was the femoral articulation which yielded first. A comparison of the means by which the two articulations are united accounts for this difference in their resistance to direct traction.

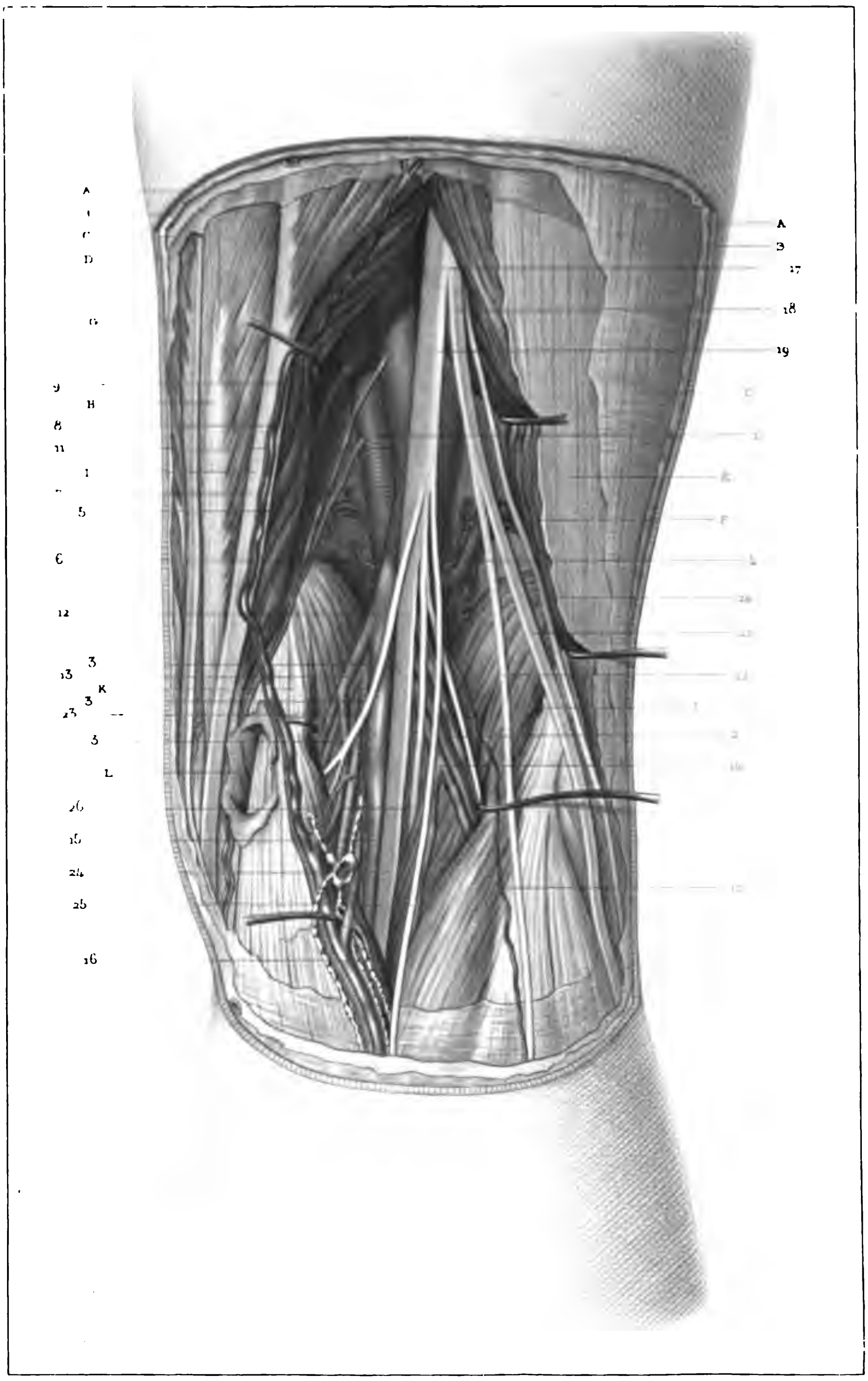
Amongst the physical lesions of this region, we must mention fracture of the patella and rupture of the tendons of the muscles. Situated at the most projecting part of the region, and constantly liable to be displaced by the action of powerful muscles, formed of a spongy tissue, having relatively little resistance, the patella is necessarily exposed to fracture. In fact, practice confirms these theoretical anticipations, and we notice in this bone every kind of fracture, that is to say, transverse, oblique, longitudinal, complete and incomplete, arising from direct or indirect causes, such as violent efforts, muscular contraction, &c.; simple and complicated. Various methods of treatment have been proposed. For our own part, we have recourse to a very simple plan, which has been remarkably successful under two conditions. During the first fifteen days we keep the limb in a grooved splint, and watch the effusion of the joint after having carefully ascertained the nature of the fracture. We apply compresses and resolvents to the knee. As the effusion diminishes, we bring together with our hands the fractured portions which may have been separated to the extent of from three to four centimetres (1·18 to 1·57 English inch). In this way we maintain, for a short time (one or two minutes), the fractured portions in contact. The next day they are again separated, but not to their former extent. We repeat this from day to day, and by the fifteenth day we succeed in bringing the two fragments into complete and permanent contact. By this time the effusion, which is the principal cause of the separation, has disappeared, and we apply bandages soaked in a solution of dextrine.

The vital lesions with which we are concerned are very numerous. We may mention acute or chronic inflammation of any of the numerous structures belonging to the region; abscesses and effusions of all kinds into the several cavities, serous and synovial. We see here the bursa (H) in front of the patella, into which the effusion occurs termed *hygroma*. In this bursa we meet with all the diseases of serous membranes: inflammation, effusion, foreign bodies, and layers of false membrane. Amongst clergymen and domestic servants, these lesions are of frequent occurrence, The bursa beneath the tendon (G) may also present the same lesions. On account of its situation, this bursa may give rise to errors of diagnosis, inasmuch as its diseases are sometimes mistaken for those of the knee-joint.

The synovial membrane of the knee is liable to a great number of alterations on account of its great extent, and more especially on account of its uses. It would require a long chapter to speak of all its diseases; we shall content ourselves with mentioning that which is especially connected with its anatomy. Notice the two superior and inferior cul de sacs (1) of this synovial membrane. These form the four projections characteristic of *hydrops articuli* and of sanguineous effusions of the joint.

The extent of the articular surfaces, the irregularities of the synovial membrane, together with the masses of fat and cellular tissue with which it is covered, readily explain the formation of foreign bodies, the persistence of inflammations, and the production of tubercle, of cancer, of exostosis, of caries, and of necrosis, which frequently attack this region.

Many operations are performed upon the knee. We shall not speak of the extraction of foreign bodies, which present nothing special here, but we shall say a word upon the disarticulation and resection of the knee. Disarticulation of the knee is not often employed, because some surgeons prefer amputation of the thigh. In performing this operation it is not possible to obtain a flap except from the front of the knee, and then it only consists of skin, a circumstance which exposes it to gangrene. Resection of the knee is often performed in England, but seldom in France. It is easily performed by reaching the articulation from its anterior surface, but the results of the operation are far from encouraging.



LIBRAIRIE GERMER BAILLIÈRE

PLATE XCVI.

Popliteal Region.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial layer of the superficial fascia.
C. Section of the deep layer of the superficial fascia.
D. Section of the superficial aponeurosis.
E. Section of the aponeurosis of the fascia lata.
F. Internal portion of the biceps femoris muscle.
G. Sartorius muscle.
H. Internal rectus muscle.
I. Semi-tendinosus muscle.
J. Gastrocnemius externus muscle.
K. Gastrocnemius internus muscle.
L. Bursa situated between the internal gastrocnemius muscle and the tendon of the semi-tendinosus muscle.

1. Popliteal artery.
2. Artery of the external gastrocnemius muscle.
3. Trunk of the artery of the internal gastrocnemius muscle and of a subcutaneous artery.
3′. Branch of the internal gastrocnemius artery.
3″. Large branch distributed to the skin.
4. Superior external articular branch.
5. Middle internal articular branch.
6. Inferior internal articular branch.
7. Small arterial branch going to the aponeurotic expansion formed by the tendons of the sartorius, gracilis, and semi-tendinosus muscles.
8. Superior internal articular branch.
9. Small anastomotic artery.
10. Small subcutaneous artery.
11. Popliteal vein.
12. Popliteal vein receiving muscular branches.
13. Vein of the internal gastrocnemius muscle joining the popliteal vein.
14. Vein of the external gastrocnemius muscle.
15. Popliteal vein passing beneath the gastrocnemii and soleus muscles.
16. External saphena vein placed between the two layers of the superficial fascia and emptying itself partly into the popliteal vein and partly into the subcutaneous veins.
17. Sciatic nerve.
18. External popliteal nerve.
19. Internal popliteal nerve at the lower part of the region.
20. Cutaneous branch of the internal popliteal nerve.
21. Deep branch of the internal popliteal nerve.
22. Peroneal saphena nerve, or external root of the external saphena nerve.
23. Nerve of the internal gastrocnemius muscle.
24. Internal popliteal nerve at the bottom of the region.
25. Tibial saphena nerve, or internal root of the external saphena nerve.
26. Nerve of the soleus muscle.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The popliteal region is a dangerous region, and abounds in all kinds of lesions.

The physical lesions are all of them dangerous, even when they are superficial. In fact, pointed, cutting, or bruising instruments which pass through the skin, may wound the internal saphena vein and the artery accompanying it, which is sometimes of considerable size, as in the present Plate. These wounds may be attended with profuse hæmorrhage, and are, therefore, proportionately dangerous. Deep wounds are dangerous in other ways; they affect, in fact, the muscles, tendons, and serous bursæ on the sides of the popliteal space, and in the space the large nerves, branches of the sciatic, or the sciatic nerve itself; the popliteal vein or its afferent branches, and the popliteal artery and its numerous ramifications. When the vein and artery are both involved at the same time, they cause an effusion of blood in the popliteal space, which easily extends into the posterior femoral region. The position of the vein over the popliteal artery throughout the whole of the popliteal space, excepting at the upper part of the region, clearly explains why these wounds are often followed by arterio-venous aneurisms. It should be observed, that according to the order of superposition, the nerve is the most exposed, then the vein, and lastly the artery. Whenever there is a wound of the artery, we may presume, according to this arrangement, that the two superficial organs are also involved, and hence the still more dangerous character of the wound, which in itself is already sufficiently dangerous.

The vital lesions of the popliteal space consist of inflammations, ulcerations, and suppurations. The inflammations and the abscesses may be: 1. subcutaneous; 2. between the two fasciæ; 3. beneath the two fasciæ: 4. beneath the aponeurosis. Each of these inflammations possesses special characters. Inflammation in the popliteal space rapidly terminates in an abscess, which, bound down on the side of the skin, has a tendency to spread either upwards or downwards. Hence the necessity of making an early opening, in order to avoid these serious complications. There are also abscesses in the popliteal space which come from above, as we have previously shown; also from below, from beneath the gastrocnemii and soleus muscles, and from the anterior part, either as the result of osteitis or of suppurative arthritis. In the suppuration accompanying white swelling, it may happen, as we ourselves have seen, that the artery ulcerates and the patient dies from hæmorrhage. This case occurred in the practice of M. Velpeau during the time we were house-surgeon in 1850, and was communicated to the *Société de Biologie* by our colleague M. Dionis des Carrières, at the present time the distinguished surgeon of Auxerre.

The numerous normal or accidental bursæ which exist in this region, may become inflamed, suppurate, and produce pus which passes into the popliteal space.

The organic lesions which require to be noticed are aneurisms and cysts. Aneurism arises from two causes, the one traumatic, the other organic. We have already shown these two causes in operation. Let us observe that we meet with every variety of aneurism, in consequence of the intimate connexion which exists between the vein and the artery. Whatever variety it may be, the symptoms will be the same. Thus, the vein and the nerve will be compressed; the sac, finding an insurmountable obstacle in the direction of the bones and of the articulation, is developed backwards, while the movements of flexion of the knee further assist in this development. Thus, although restricted by the popliteal aponeurosis, the aneurismal tumour speedily projects. At first there is compression of the popliteal vein, with swelling of the limb behind and on the outer side. At a later period there is compression of the sciatic nerve, or of its branches, causing paralysis of sensation and motion in the subjacent parts.

Cysts are somewhat frequent in the popliteal space. This frequency is explained by the number of normal and accidental bursæ which occur in the region. Some of these abscesses, however, arise from the knee-joint itself, produced by a kind of hernia of the synovial membrane. We noticed one variety which must be exceedingly rare, during the time we were prosector at Clamart. The cyst was formed by the aponeurotic sheath of the popliteal muscle, which, having disappeared from atrophy, had been replaced by the thick synovial fluid coming from the synovial membrane of the knee-joint.

The numerous lymphatic glands of the region may become inflamed, suppurate, and themselves converted into cysts. When they form a tumour in consequence of any of these lesions, they are situated upon the vessels, and the pulsation of the latter may in some cases be transmitted to them, so as to produce the idea of the presence of an aneurismal tumour. Hence arises a cause of error which the discreet surgeon will always know how to avoid.

A ligature may be applied in the popliteal space to the artery of the same name. The following are the rules for the performance of this operation. An oblique incision is to be made from the upper part of the region on its inner side to the middle of the popliteal space, passing a little below and towards the outer side. By making this incision it is proposed to avoid the external saphena vein which enters the popliteal vein towards the middle and lower part of the region. We pass through the skin and the two fasciæ, and at once divide the aponeurosis. When the popliteal space is opened, we make use exclusively of the grooved director and of the forceps. We meet with the sciatic nerve or its branches which are put aside with a blunt tenaculum. Below the nerve we see the vein, which is thick, and generally almost resembling an artery; this is carefully separated from the artery, and the ligature is applied to the latter by a dexterous turn of the hand, by which the grooved director is made to pass between the two vessels, so as to raise up the artery, while at the same time it depresses the vein and the nerve.

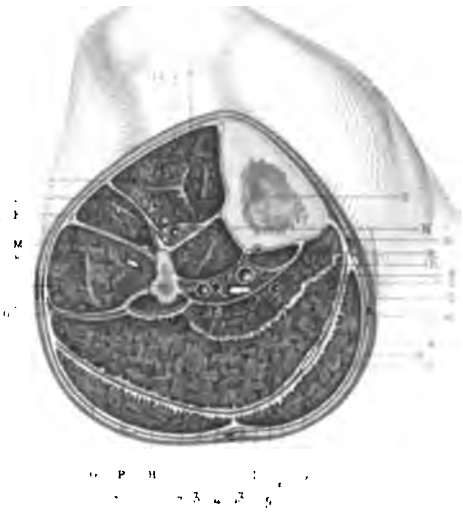
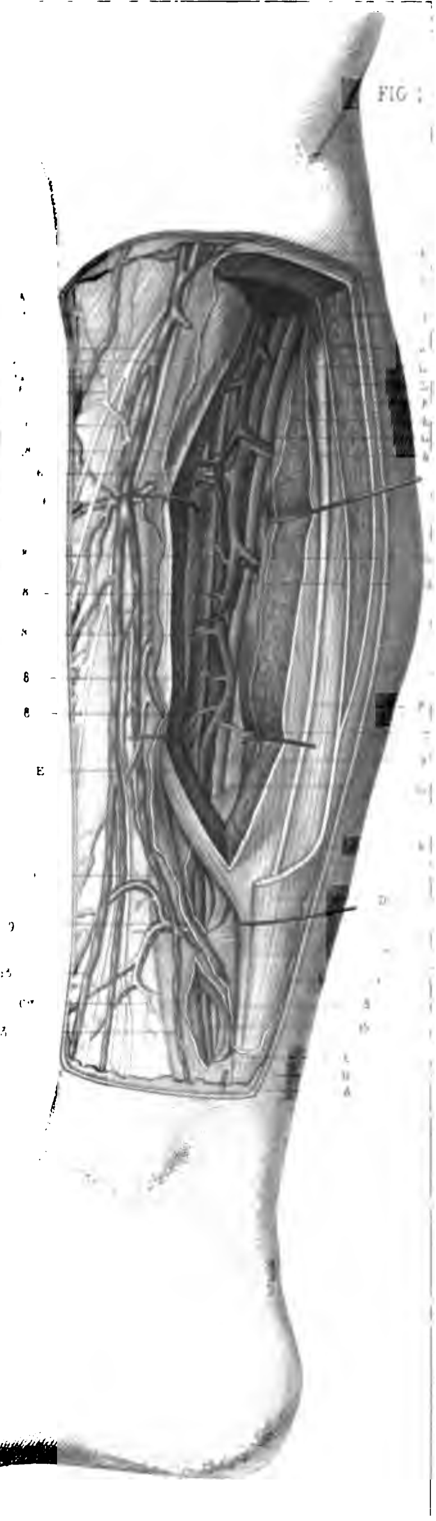


FIG. 2



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LIBRAIRIE GERMER BAILLIERE

PLATE XCVII.

FIGURE 1.—Posterior Tibial Region.

EXPLANATION.

A.	Section of the skin bounding the region.
B.	Section of the subcutaneous fatty cellular tissue.
C.	Superficial aponeurosis or covering.
C′.	Section of the superficial aponeurosis opposite the tendo Achillis.
C″.	Deep aponeurosis passing beneath the tendo Achillis and covering the posterior tibial vessels and nerves.
C‴, C⁗.	Section of the superficial aponeurosis.
C′⁗.	Section of the superficial aponeurosis where it is almost united to the deep aponeurosis.
D.	Vertical section of the soleus and the gastrocnemii muscles.
D′.	Tendo Achillis.
E.	Section of the soleus muscle.
E′.	Posterior surface of the soleus muscle.
F.	Plantar muscle.
F′.	Tendon of the plantar muscle.
1.	Posterior tibial muscle at its upper part.
2.	Posterior tibial artery at its middle part.
3.	Posterior tibial artery at its lower part.
4, 5, 6, 7, 8.	Muscular branches furnished by the posterior tibial artery.
6′, 6″.	Cutaneous branches furnished by the preceding muscular branches.
9.	Cutaneous branch furnished by the posterior tibial artery.
10.	Posterior tibial vein.
11.	Muscular venous branch going to join the posterior tibial vein.
12.	Posterior tibial veins accompanying the artery of the same name.
13, 13, 13.	Principal branches of the internal saphena vein.
14.	Branch of the internal saphena vein.
15.	Posterior tibial nerve.
16.	Internal saphena nerve.
17.	Cutaneous branches of the internal saphena nerve.
18.	Middle branches of the internal saphena nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The physical lesions of this region present no special peculiarity, unless it is the possibility of the complication arising of a wound of the internal saphena vein; but is this really a complication? Is not the bleeding easily arrested, and is there any reason to fear the occurrence of phlebitis if the wound is treated in a proper manner? Deep wounds which reach the tibial artery are undoubtedly more serious, but with the exact anatomical knowledge which we possess in the present day, we can readily avert all danger. Amongst the physical lesions, we may mention rupture of the tendon of the plantar muscle, which is accompanied with a tolerably loud noise. This tendon is seen at F′ Figure 1, its slenderness favours the occurrence of this accident.

Amongst the vital lesions we may mention more particularly varicose veins. This condition may affect the superficial or subcutaneous veins, and the tibial and peroneal veins at the same time. M. Verneuil has even endeavoured to show that the varicose condition of the deep veins always precedes that of the superficial. This discovery, which explains to us more fully the nature of this disease, also shows us that the treatment must be attended with still greater difficulties. We have been able to verify the correctness of M. Verneuil's discovery; but, while admitting with him the frequent coincidence of a varicose condition of the deep veins with a similar state of the superficial veins, we do not go so far as to say with him that the varicose state of the deep veins invariably precedes that of the superficial vein.

The operations which are performed in this region are more particularly the ligaturing of arteries. Thus the posterior tibial artery may be tied in three places (1, 2, 3.) An examination of this drawing gives all the information that is necessary for the proper application of each of these ligatures. Let us begin with the ligature at the lower third of the artery, that is, opposite number 3; but first we will represent by an imaginary line the course the artery pursues throughout its entire length. This course may be represented with sufficient accuracy by a line commencing from the posterior surface of the internal condyle, and which, passing parallel to the inner edge of the tibia, reaches the middle of the space between the posterior margin of the malleolus and the inner margin of the tendo Achillis. To apply a ligature to the lower third of the tibial artery, we therefore make an incision whose centre corresponds to number 3, and which measures about six centimetres (2·36 English inch) in length. After dividing the skin, we meet with the subcutaneous fascia; this is cut through, and we reach the aponeurosis. It may be seen, that here, as in the rest of its course, the artery is covered by two aponeuroses. Only the two layers are here close to each other, so that some precautions are necessary in order to divide them separately. The artery is seen to be accompanied by two veins; both of them are often somewhat dilated and their coats hypertrophied. In consequence of these changes, there is sometimes so close a resemblance between the veins and the artery, that it is necessary to guard against mistaking the one for the other. Moreover, this remark will apply to all the arteries of the leg. To avoid this mistake, it is sufficient to remember that the artery is placed between the other two vessels.

The same rules are to be followed at the middle as at the lower part of the artery. After exposing the superficial fascia, an incision is made close to the tibia, and carried behind the inner border of the soleus muscle. The vessel is seen beneath, and is then to be tied. It is laid bare by cutting obliquely and the ligature applied.

At the upper part of the artery the application of a ligature is very difficult, owing to the depth at which the vessel is placed. The same rules are followed as far as the superficial aponeurosis, care being taken to avoid wounding the internal saphena vein. The aponeurosis and the soleus muscle are divided. The deep aponeurosis is thus reached, which is divided by an oblique incision. The artery being exposed, it is laid bare, and the ligature applied with the greatest care in the usual way.

Figure 2.—Transverse Section of the Middle of the Leg.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the superficial aponeurosis or covering.
D. Intermuscular aponeurosis.
E. Section of the common extensor muscle of the toes.
F. Section of the peronœus, longus, brevis, and tertius.
G. Section of the external gastrocnemius muscle.
G′. Section of the internal gastrocnemius muscle.
H. Section of the soleus muscle.
H′. Section of the long flexor muscle of the great toe.
I. Section of the deep fibres of the soleus muscle.
J. Section of the tibialis posticus muscle.
K. Section of the long flexor muscle of the toes.
L. Section of the tibialis anticus muscle.
M. External intermuscular aponeurosis.
N. Interosseous ligament.
O. Intermuscular aponeurosis.
P. Aponeurotic insertion of the soleus muscle.
Q. Fibrous intersection of the soleus muscle.
R. Deep aponeurosis of the leg.
S. Section of the tibia.

1. Anterior tibial artery.
2. Posterior tibial artery.
3. Peroneal artery.
4, 5. Artery of the gastrocnemii and soleus muscles.
6. Anterior tibial veins.
7. Peroneal veins.
8. Posterior tibial veins.
9. Veins of the internal portion of the gastrocnemius muscle.
10. Internal saphena vein.
11. Collateral branch of the internal saphena vein.
12. Anterior tibial nerve.
13. Posterior tibial nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

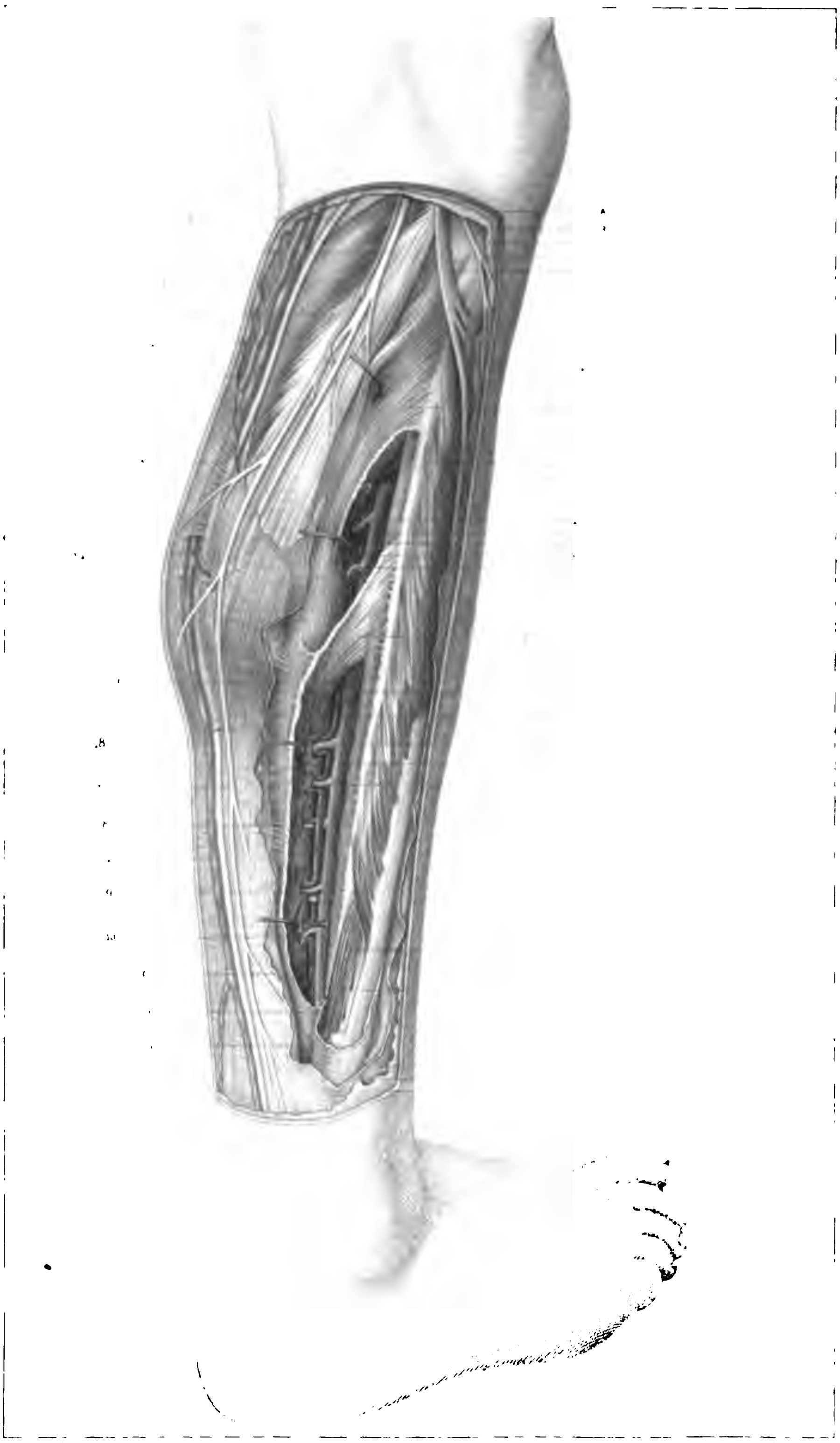
Figure 2 of the present Plate is intended to show the relative position of the vessels, and to facilitate the application of ligatures to them after amputation at the middle of the leg.

At the anterior part of the section contained between the tibia and the fibula, between the tibialis anticus and the extensor communis digitorum, is seen a large artery. This is the anterior tibial artery, which is generally tied first after amputation of the leg; this artery is easily tied on account of its size, and more especially because it does not become retracted like the interosseous arteries of the fore-arm.

Secondly, in the posterior segment of the section, between the tibia and the fibula, are two large arteries, the posterior tibial and the peroneal. The ligature should be applied to the posterior tibial first, because it is the largest. The surgeon will easily find it within the interosseous space, close to and behind the external border of the tibia. This vessel, like the peroneal artery, is so placed that a cutting and pointed instrument carried into the interosseous space, might reach the three arteries of the leg at the same time, if it was directed from before backwards, and somewhat obliquely from without inwards. The peroneal artery is not placed behind the fibula, as might be supposed, but opposite the inner surface of the bone; it is, therefore, at this part, and at a short distance behind the deep aponeurosis of the region, that the artery will be found.

After having ligatured the three principal vessels, the surgeon is still not clear of all primary hæmorrhage, that is to say, it is necessary for him to tie some muscular branches which increase in size the nearer they are to the knee. Thus, on examining Figure 2, there is seen in the substance of the tibial muscles an artery which requires a ligature. It will therefore, be necessary both at the upper and middle part of the leg to tie five vessels after amputation. At the lower part of the region only three ligatures will be required, because the arteries of the gastrocnemii muscles do not extend to the lower third of the leg.

PLANCHE XVIII



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XCVIII.

Region of the Fibula.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
B′. Fold of the superficial fascia surrounding the internal saphena vein.
C. Section of the superficial aponeurosis at the upper part of the region.
C′. Section of the superficial aponeurosis towards the middle of the region.
C″. Deep aponeurosis.
C‴. Section of the deep aponeurosis.
D. Peronæus longus muscle.
E. Peronæus brevis muscle.
F. Flexor longus pollicis.
F′. Inferior attachments to the fibula of the flexor longus pollicis.
G. Gastrocnemius externus muscle.
G′. Tendo Achillis.

1. Peroneal artery at its upper part.
2. Peroneal artery at its middle part.
3. Peroneal artery at its lower part.
4, 5, 6, 7, 8, 9, 10. Muscular branches given off by the peroneal artery.
11. Inferior ramifications of the external and inferior articular artery.
11′. Small branch of the external and inferior articular artery.
12, 12, 13, 13. Peroneal veins accompanying the artery of the same name.
14, 14, 14. Branches and trunk of the external saphena vein.
15. External popliteal nerve.
16. Cutaneous branch of the external popliteal nerve.
17, 17. External root of the internal saphena nerve.
18. External saphena nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds of the peroneal region differ according as they are superficial or deep. Those which are superficial are generally attended with but little danger. If, however, they are accompanied by an extensive laceration of the skin, if they extend to the external saphena vein, or even the saphena nerve, they are somewhat more dangerous. If the wound occurs in a person with varicose veins, it will generally be followed with hæmorrhage that is arrested with difficulty, and sometimes also by an ulceration of the tissues, which has received the name of *varicose ulcer*. If a cutting instrument passes beyond the aponeurosis, it may wound the muscles, vessels, nerves, and even the bone itself. Let us briefly examine these wounds. When the soleus, the gastrocnemii muscles, the peronæus longus and brevis above, and the flexor longus pollicis, only are injured, the wound is not serious; but if the sheath of the peroneal muscles is laid open at the lower part of the region, or the articulation of the fibula and tibula at its upper part, there arises a special source of danger, especially if, as sometimes happens, the articulation communicates with the knee-joint. When the sheath of the peroneal muscles is wounded, it is necessary to bear in mind all the ill-consequences which may ensue, such as inflammation, sanguineous or serous effusion, the formation of foreign bodies, swelling of the region, and lastly, difficulty and pain in walking. The vessels and peroneal nerves, as may be seen in this Plate, are well protected in front by the fibula, but not at all, or only slightly so, behind and at the sides. The mass of muscles, and the aponeuroses, in fact, serve as a protection, but they cannot always prevent cutting, pointed, or blunt instruments from passing through the soft parts and reaching these deep-seated vessels. It is in consequence of the depth at which the peroneal artery is placed, that the hæmorrhage which accompanies or follows a wound of it is attended with great danger. In fact, if the wound is at the upper part, and astringents and direct compression do not succeed in arresting it, almost the only resource is to ligature the popliteal artery, a plan which some surgeons do not adopt. These surgeons must resort to ligaturing the femoral artery. We see, therefore, that this is a very serious wound.

Fractures of the fibula are of two kinds, direct or indirect. Direct fractures are produced by a blow, a fall, the wheel of a carriage passing over the leg, or by fire-arms. Indirect fractures are not so frequent, and are produced in a very curious manner. When the foot is turned outwards, the end of the external malleolus presses upon the external surface of the calcaneum; the fibula is, therefore, placed between two forces which act in the direction of its axis, but the inferior fibulo-tibial articulation ultimately gives way, the fibula is carried outwards, and as it is not displaced at its upper part, a fracture occurs a little below the neck of the fibula, near the upper third of the bone. In both varieties of fracture the broken portions do not become displaced, being retained in position by the muscles, aponeuroses, and the interosseous ligament.

Inflammations and abscesses of the part present nothing special. It is only necessary to mention inflammation of the internal saphena vein and of the sheath of the peronæus longus and brevis.

Organic lesions are not of frequent occurrence; there is, however, one to which we must call attention: we refer to vascular cancer, which attacks by preference the head of the fibula. Although it is rare, this disease sometimes shows itself, and we have ourselves obtained two specimens. In these cases it is necessary to perform resection of the upper extremity of the fibula.

It is very necessary carefully to study this region, in order to apply a ligature to the peroneal artery, which is one of the most difficult to perform in the human body. This difficulty consists not only in the depth at which the artery is placed, but also in the variation which occurs in its length and size. Sometimes, in fact, this artery has a long course, while at other times it is very short; sometimes it is as large as the posterior tibial artery, as shown in the present Plate; while, on the contrary, at other times it is extremely small. It is true, in the latter case, it will not be difficult to arrest the hæmorrhage, and that then a ligature will not be necessary.

However this may be, a ligature may be applied to the peroneal artery in three places: at the upper, middle, and lower part of the region. But we must always have a vessel resembling the one before us, to be able to establish these divisions. In general this ligature is only applied to the middle of the artery, and whatever rules are necessary for this are equally applicable to the performance of the operation at the upper or lower parts of the region.

An incision is made one centimetre (0·39 English inch) behind the fibula, and from six to seven centimetres (2·36 to 2·68 English inch) in length at the middle part of the region. The tissues are divided as far as the external edge of the fibula, which, together with the peroneal muscles, is the first guide. If these muscles are small they are pushed forwards. The deep aponeurosis, which serves for the insertion of the gastrocnemii and soleus muscles, is exposed; this aponeurosis is detached from the fibula, and if a thick aponeurosis is met with at its under surface it is divided upon a grooved director; the artery is found beneath it accompanied by two veins, which are often varicose, and cover it more or less. Hence the necessity for the surgeon to separate these vessels with the greatest care, if he would avoid the difficulty of a quantity of blood remaining at the bottom of an irregular-shaped wound. This operation has been performed once by Guthrie on a man who had secondary hæmorrhage from a wound of the artery.

FIG. 1

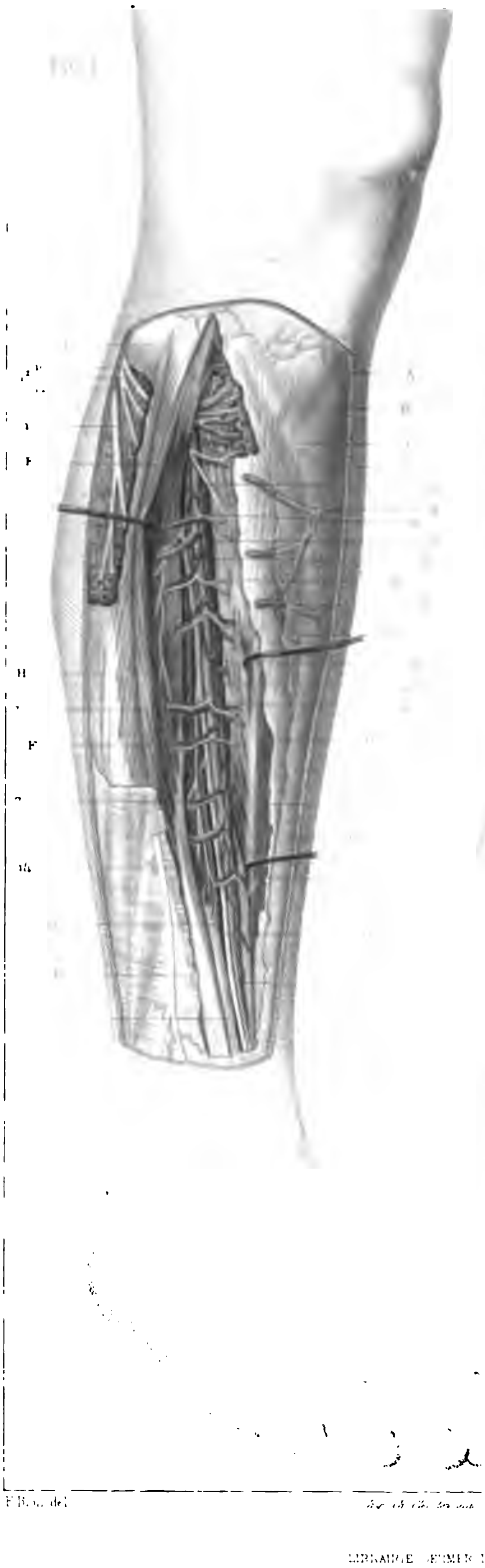
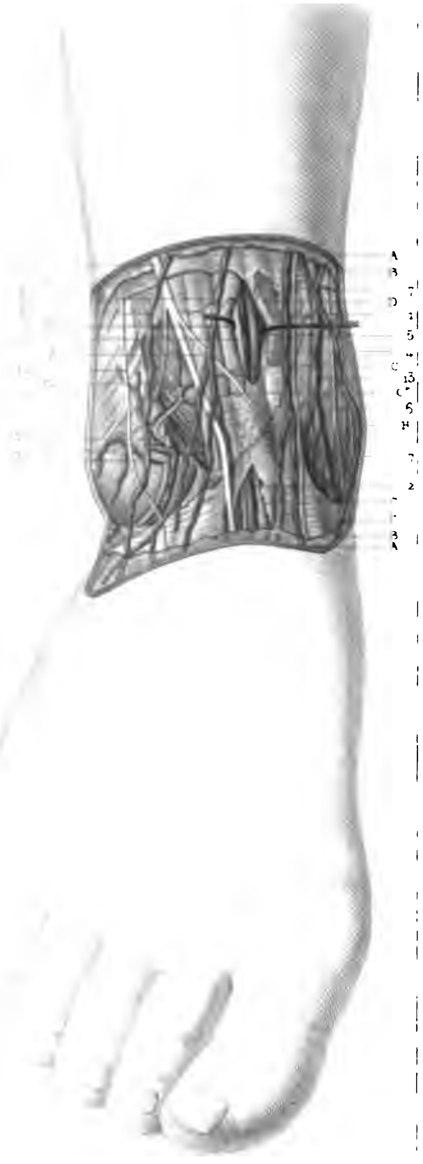


FIG. 2



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LIBRAIRIE GERMER BAILLIÈRE

PLATE XCIX.

Figure 1.—Anterior Tibial Region.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous cellular tissue.
C, C, C. Superficial aponeurosis.
D. Aponeurotic insertion of the muscles of the region.
E. Extensor communis digitorum.
F. Tendon of the extensor communis digitorum.
G. Extensor muscle of the great toe.
G′. Tendon of the extensor muscle of the great toe.
H. Peronæus longus and brevis muscles.
I. Insertion of the peronæus longus and the head of the fibula.
J. Superficial aponeurosis of the leg joining the aponeurotic insertion of the tibialis anticus opposite the crest of the tibia.

1. Anterior tibial artery at its upper part.
2. Anterior tibial artery at its middle part.
3. Anterior tibial artery at its lower part.
4, 4, 4. Muscular branches furnished by the anterior tibial artery.
5, 6, 6. Anterior tibial veins accompanying the artery of the same name.
7, 7. Muscular veins joining the anterior tibial veins.
8, 8. Superficial veins communicating between the saphena veins.
9, 9. Anterior tibial nerve.
10. External popliteal nerve.
11. Musculo-cutaneous nerve dividing into two branches.
12. Origin of the anterior tibial nerve.
13. Recurrent, muscular, and articular branches of the external popliteal nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Wounds and contusions of the anterior tibial region offer some peculiar conditions which it is necessary to point out. These conditions remind us of those which we have already noticed in the head. Thus we remarked: wounds of the eyebrows differ from other wounds, inasmuch as the orbital arch itself performs the office of the instrument inflicting the wound, and such a wound while it appears small externally, may be very extensive internally. Here, also, we meet with wounds presenting this character. In fact, if we consider the spine and the crest of the tibia, and the tissues covering it, we shall be convinced that we have then all the conditions belonging to the supra-orbital region. If a blunt instrument comes against the crest of the tibia, the skin will be pressed against it, and this will cut from within outwards; if the instrument acts obliquely, from above downwards, for instance, there will be a wound with laceration and separation of the skin. These wounds, therefore, require great care. When the force is not so great, the skin separates from the tibia and the aponeurosis of the leg, and produces a sanguineous swelling similar to those of the cranial arch. These swellings and extensive separation of the skin are more frequent here than elsewhere, precisely because the skin glides easily in front of the parts which it covers. When the instrument with which the wound is inflicted passes through the aponeurosis, the anterior tibial artery may be wounded or laid bare. In a case which recently occurred in our practice, the aponeurosis was laid open, the muscles protruded through the opening, and when the finger was introduced between the tibialis anticus and the extensor muscles, the pulsation of the artery could be distinctly felt. This wound healed without being complicated with hæmorrhage.

The tibia, like the fibula, is often fractured, either from a direct or an indirect cause. In this respect it is to be observed that this bone is much more frequently fractured at its inferior third than elsewhere, a circumstance which is explained by the smaller size of the bone at this part, and its consequently diminished power of resistance. Amongst the operations performed in this region, we shall mention those for the removal of splinters or of necrosed portions of bone, and the operations for false joints. It is to Mr. Jordan of Manchester, whatever may be said to the contrary, to whom the honour is due of having first proposed and performed an autoplastic operation of the periosteum for the cure of these false joints. This surgeon was also the first to employ the term *periosteal autoplasty*. We cannot, therefore, understand the obstinacy with which a fact so evident and so clearly proved by his published writings has been denied. Let us, however, pass on, and consider the application of a ligature to the anterior tibial artery.

The direction of this artery is represented by an imaginary line, commencing at the middle of the space included between the head of the fibula and the spine of the tibia, and reaching to the centre of the intermalleolar space. A ligature may be applied to the artery in three places.

Above, the operation is performed in the course of the supposed line in a space varying from five to six centimetres (1·96 to 2·36 English inch) in length. The crest of the tibia is to be sought for as our first guide, and then the first intermuscular space from the crest. This is recognised by a yellow line on the aponeurosis of the leg, which is seen to be more strongly marked lower down. The aponeurosis is divided in the course of this line, and the space entered, at the bottom of which we meet with the artery.

In the middle, the ligature is applied according to the same principles. We have only to avoid the danger of passing into the second intermuscular space. Here, in fact, the extensor muscle of the great toe is interposed, and it is the first space which must be entered, that is to say, the one between the tibialis anticus and the extensor muscle of the great toe.

Below, the mistake is more easily avoided, because the extensor of the great toe is more voluminous, and the space which bounds it externally is larger; but still the same principles should guide the operator.

FIGURE 2.—Region of the Instep.

Anterior surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the superficial fascia.
C. Superficial aponeurosis.
C′. Section of the superficial aponeurosis showing the tibial vessels and nerves.
C″. Section of the superficial fascia showing the tendon of the anterior tibial muscle.
C‴. Section of the superficial aponeurosis showing the tendons of the extensor muscles in their sheath.
D. Tibialis anticus muscle.
E. Tendon of the extensor proprius pollicis muscle.
F. Tendon of the extensor communis digitorum.
G. The lowermost fibres of the extensor communis digitorum.
H. Internal malleolus.
I. External malleolus.

1. Anterior tibial artery at the upper part of the region.
2. Anterior tibial artery at the lower part of the region.
3. External malleolar artery.
3′. Descending branch of the external malleolar artery.
4, 5. Veins accompanying the anterior tibial artery.
6. Internal saphena vein opposite the internal malleolus.
7, 7. Collateral branches of the internal saphena vein.
8, 9. External and anterior collateral branches of the internal saphena vein.
10. Anterior tibial nerve.
11. Cutaneous branch of the muscular cutaneous nerve.
12. Malleolar cutaneous branch of the musculo-cutaneous nerve.
13. Terminal branches of the internal saphena nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The anterior surface of the instep includes a number of organs whose wounds may prove dangerous, it is what is sometimes termed one of the dangerous regions. Deep wounds may, in fact, reach large vessels both in the middle and at the sides of the region. Thus, the anterior tibial artery being superficial and only protected by the anterior ligament, is very liable to be wounded. It is the same with regard to the malleolar arteries, which have not even the same protection as the anterior tibial artery. The projection formed by the tendon of the tibialis anticus muscle readily explains the frequent occurrence of contusions of this tendon and its sheath. It is no doubt for this reason it has received the name of *musculus catenæ*. We have said that the wounds of this region are dangerous: the following is a proof of it. If a cutting or bruising instrument comes in contact with the region, it may pass through the soft parts and reach the bones which concur in forming the skeleton of the region and its numerous articulations. Thus, for instance, the inferior extremity of the tibia, that of the fibula, the two malleoli, the astragalus, the tibio-tarsal articulation, the inferior tibio-fibular articulation, may all be injured by external violence. Add to this that foreign bodies may become lodged in the intervals of the muscles or in the numerous depressions of the bones, and we can form some idea of the danger attending these wounds.

Amongst the organic lesions of the region, we may mention caries, necrosis, white swellings, and others.

Only one established operation is performed at this part, and that is ligature of the tibial artery. The proper rules for the performance of this operation are readily understood. An incision must be made in the middle of the intermalleolar space four centimetres (1·47 English inch) in length; this exposes the projecting tendon of the tibialis anticus muscle, and in the space included between this tendon and that of the extensor proprius pollicis, the artery is met with.

FIG. 1

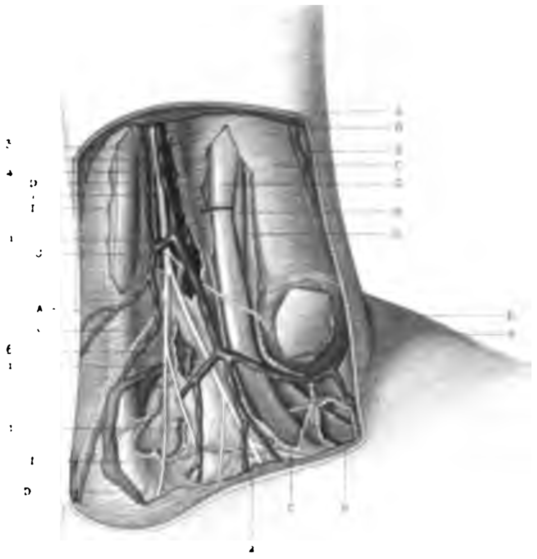
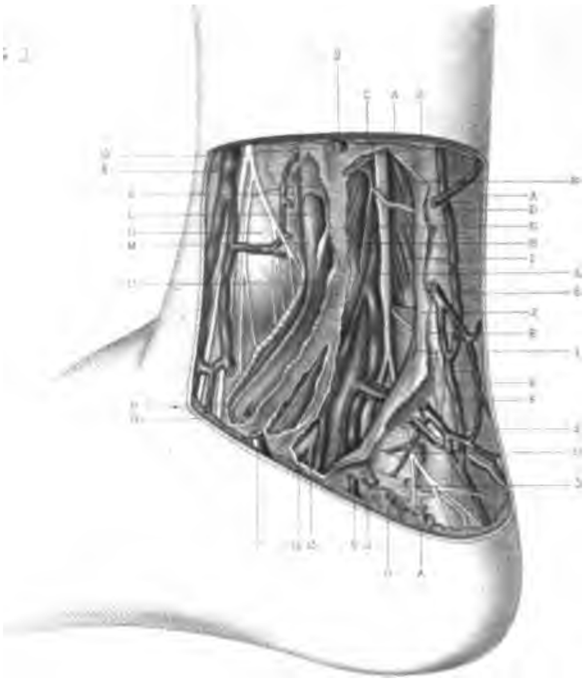


FIG. 2



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LIBRAIRIE GERMER BAILLIERE

PLATE C.

FIGURE 1.—Region of the Instep.

External surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C, C. Superficial aponeurosis.
D, D, D, D. Section of the superficial aponeurosis covering the subjacent organs.
E. Bursa situated on the external malleolus.
F. Section of the bursa on the external malleolus.
G, G. Section of the tendon of the peronæus longus.
H, H. Tendon of the peronæus brevis.
I. Tendo Achillis.
J. Section of the fibrous sheath supplied to the tendo Achillis by the superficial aponeurosis.

1, 1, 1. Terminal branches of the peroneal artery.
2. Anastomosis of the peroneal artery with the external malleolar artery.
3. External saphena vein.
4. Collateral branch of the external saphena vein.
5. Anterior ramification of the internal saphena vein.
6. Veins accompanying the terminal branches of the peroneal artery.
7. External saphena nerve terminating in the region.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This region affords numerous applications to surgery, a circumstance which is fully explained by the number of organs it contains.

In respect to wounds, it is at once seen that they may reach the different bursæ belonging to the region. These bursæ are four in number, viz., a serous bursa on the external malleolus, the synovial bursa belonging to the tendons of the peroneal muscles, the aponeurotic and serous sheath of the tendo Achillis, and lastly, the serous bursa which is placed between the calcaneum and the tendo Achillis. All wounds of bursæ are serious, because they may give rise to a dropsical condition of the bursa, to effusion of blood, to an accumulation of pus, and to fibrous formations. Amongst these bursæ, the one which without doubt is most frequently affected, is that belonging to the tendons of the peronæus longus and brevis. Although they are separated below, these serous bursæ communicate freely above, so that in reality they form but a single cavity. When the serum accumulates in their cavity, it produces a tumour occupying the external and lower part of the leg, and sometimes it extends into the sole of the foot, where, as we know, the sheath is continued and covers the tendon of the peronæus longus. Frequently the swelling is not apparent at this part, because the fibrous tissues of the sole of the foot do not allow of the distension of this sheath. Moreover, it often happens that when the tendon passes beneath the plantar surface of the foot, there is a septum which divides the sheath into two parts. This explains why the tumour does not project towards the plantar surface.

Wounds of the vessels and nerves of this region are not of a serious character. The bones of the region, and particularly the external malleolus, are frequently the seat of fractures. These fractures are generally caused in the following manner. When the foot is turned inwards, the lateral ligaments of the tibio-tarsal articulation are forcibly stretched; as they are very strong, in general they resist; but if the violence is too great, it is the bone which yields, and the point of the external malleolus is torn off to a greater or less extent: this is an instance of fracture by tearing. If the point of the foot is turned outwards, or, what produces the same result, if the foot is extended, and the tibia and the body are suddenly rotated, the external malleolus will be the point upon which the whole force of the movement will be exerted; the foot being turned outwards, the anterior border of the malleolus will form the point of resistance; it will ultimately give way, the fibulo-tibial ligaments will be ruptured, and the fracture will occur at two centimetres (·78 English inch) below the malleolus.

Amongst the operations performed in this region, we shall especially mention section of the tendo Achillis. We may observe that in respect to the operation on the outside of the tendon there is no organ of any real importance that can be wounded. We shall see that this is not the case on the inner side.

FIGURE 2.—Region of the Instep.

Internal surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Superficial aponeurosis.
D. Superficial aponeurosis covering the internal surface of the tendo Achillis.
E. Section of the superficial aponeurosis showing the posterior tibial vessels and nerves and the tendons of the flexor muscles of the toes.
F. Section of the aponeurosis showing the tendo Achillis.
G. Flexor longus digitorum enclosed in its aponeurotic sheath.
H. Section of the aponeurotic sheath of the flexor longus digitorum.
I. Flexor longus pollicis.
J. Aponeurotic sheath of the flexor longus pollicis.

K. Tendo Achillis seen through an opening in the superficial aponeurosis.
L. Tendon of the tibialis posticus enclosed in its aponeurotic sheath, from which it receives a membranous expansion.
M. Membranous and fibrous expansion furnished by the aponeurotic sheath of the tendon of the tibialis posticus muscle.
N. Tendons of the flexor brevis digitorum enclosed in their aponeurotic sheath.

1. Posterior tibial artery.
2, 3. Internal calcaneal branches furnished by the posterior tibial artery.
4. Veins accompanying the posterior tibial artery.
5. Origin of the internal saphena vein.
6. Branch forming the commencement of the internal saphena vein coming from the sole of the foot.
7. Anterior branch of the internal saphena vein.
8. Internal saphena vein opposite the internal malleolus.
9. Section of one of the collateral branches of the internal saphena vein.
10. Posterior tibial nerve.
11. Calcaneal branch of the posterior tibial nerve.
12. Tibial nerve going to the plantar surface of the foot.
13, 14. Other branches of the tibial nerve going to the plantar surface.
15. Terminal branch of the internal saphena nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

If wounds on the external region of the instep are dangerous, those on the internal region are still more so. It is sufficient to examine the region to be convinced of the truth of this statement. It is seen at once that here, as on the external side, we have muscles, tendons, sheaths, bones, and articulations, but there are more arteries and veins, as well as principal nerves, whose wounds are necessarily serious. Amongst the serous and synovial bursæ, we will mention first those of the tibialis posticus and flexor brevis digitorum muscles, of the tendo Achillis, and lastly, the one which is placed between this tendon and the calcaneum, and which shows itself at the same time on both the external and internal side of the tendon. What has been said concerning the diseases of the common sheath of the peronæus longus and brevis muscles, also applies to the separate sheaths of the tibialis posticus and flexor longus digitorum muscles, with this difference, that here there is a separation between the sheaths. A serous bursa is sometimes met with on the superficial surface of the internal malleolus. Amongst the wounds which are met with in this region, we may mention those of the posterior tibial artery, as well as those of the superficial veins, or of the deep veins which accompany the artery. It is unnecessary to do more than name wounds of the bones and of the tibio-tarsal articulation.

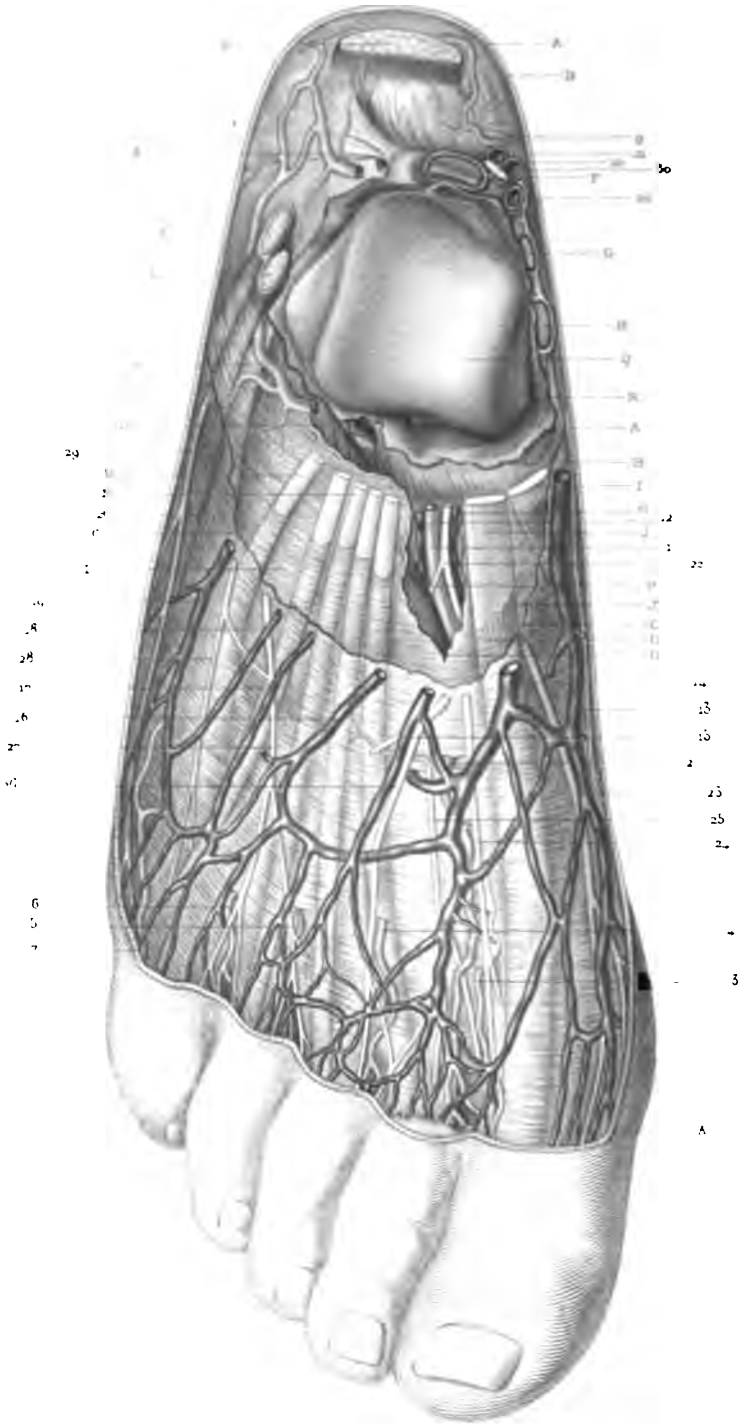
Fractures of the internal malleolus are rarely produced by a direct cause, but, on the contrary, by an indirect action, and then accompanying fracture of the external malleolus. Thus, when the foot is turned directly outwards, the internal malleolus is easily torn off. We saw a very curious case in which this malleolus had been divided at its base as if by a cutting instrument; the sharp edge at the seat of division had divided the skin and all the tissues down to the bone, including the internal saphena vein. The wound communicated freely with the external bone, and the superior surface of the astragalus, dislocated inwards, formed a projection through the wound. We reduced the dislocation, applied cold water dressings, and by preventing all movement in the foot obtained a complete cure. At the present time the patient is able to walk, and feels nothing of his injury.

Some important operations are performed here: we refer to bleeding, to the application of a ligature, and to the division of the tendo Achillis.

Bleeding from the internal saphena vein, which was formerly much practised, is not employed at present. However this may be, it is seen that the internal saphena vein, after it has received the veins from the dorsal, and from a considerable portion of the plantar surface of the foot, forms a large trunk opposite the internal malleolus. It is at this part that it should be opened. In order to render it tumid, a ligature should be placed above the malleoli, or, what is better, the feet should be placed in hot water. When sufficiently distended, the vein is fixed with the fingers of one hand, and opened with the lancet held in the other hand. There are good grounds for recommending that the lancet should not be introduced perpendicularly, in order to avoid the point of it penetrating the periosteum, or even the bone itself, and so becoming broken and remaining in the tissues.

Ligaturing of the posterior tibial artery behind the malleolus is very simple. Midway between the posterior edge of this malleolus and the internal border of the tendo Achillis, a curved incision is made, which passes parallel to the curve of the malleolus. The superficial aponeurosis is reached, which, becoming blended with the deep aponeurosis, forms a very thick layer. This is opened upon a grooved director. The two veins, which are large, and from their dull colour somewhat resemble the artery, must be separated from it; in order to distinguish them it is, however, sufficient to remember that the artery is always placed between the two veins.

With regard to the division of the tendo Achillis, which is principally performed for the treatment of club-foot, it presents no difficulty. The foot being extended, the tendon is separated from the deep organs, and thus there is a greater security against their being wounded. The posterior tibial artery, which, above all, it is most important not to wound, is situated at a considerable distance from the internal border of the tendon. The instrument is introduced from the inner side beneath the tendon which projects and is cut from its deep to its superficial surface. We know that the tendon is completely divided by a sensation of resistance overcome, and by the power which is acquired of producing more extended movements than before its division.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE CI.

Dorsal Region of the Foot.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty fascia.
C. Superficial aponeurosis.
D. Deep aponeurosis of the region.
D′. Section of the deep aponeurosis to show the vessels of the foot.
E. Section of the tendo Achillis.
F. Section of the tendon of the flexor longus pollicis enclosed in its sheath.
G. Section of the tendon of the flexor longus digitorum enclosed in its sheath.
H. Section of the tendon of the tibialis posticus enclosed in its proper sheath.
I. Section of the tendon of the tibialis anticus.
J. Section of the extensor proprius pollicis.
K. Section of the tendon of the peroneus longus enclosed in its fibro-synovial sheath.
L. Section of the tendon of the peroneus brevis enclosed in its fibro-synovial sheath.
M, N. Section of the tendons of the extensor longus digitorum.
O. Section of the tendon of the peroneus tertius.
P. Muscular fibres of the extensor brevis digitorum.
Q. Pulley-like surface of the astragalus.
R. Section of the synovial membrane of the tibio-tarsal articulation.

1. Dorsal artery of the foot.
2. Metatarsal artery, branch of the dorsal artery.
3. Dorsalis pollicis artery.
4, 5, 6, 7. Interosseous arteries furnished by the dorsal artery or by the metatarsal artery.
8. Calcanean artery furnished by the peroneal artery.
9. Calcanean artery furnished by the posterior tibial artery.
10. Section of the posterior tibial artery.
11, 12. Dorsal veins of the foot.
13. Metatarsal veins going to join the internal saphena vein.
14. Section of the principal metatarsal veins.
15, 16, 17, 18, 19. Section of the external metatarsal veins.
20, 21. Section of the veins which accompany the posterior tibial artery about to become the plantar artery.
22. Internal dorsal nerve.
23, 24, 25, 26, 27, 28, 29. Terminal branches of the musculo-cutaneous nerve furnishing the collateral nerves of the toes.
30. Posterior tibial nerve going to form the plantar nerve.

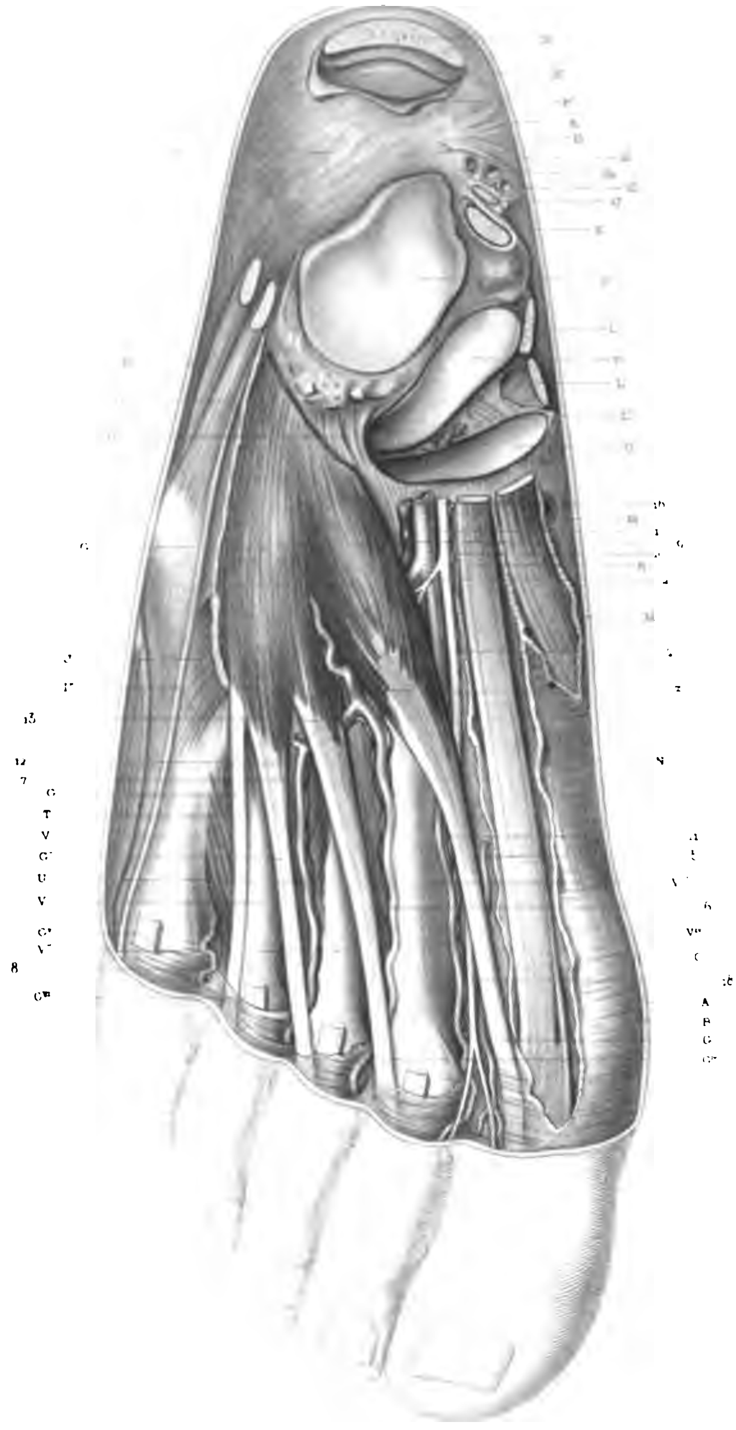
APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Considering the dorsal surface of the foot in relation to its physical lesions, we may establish two portions distinctly separated from each other. The one is situated posteriorly, and connected with the leg, and consequently serving to sustain the whole weight of the body. The other is a kind of free appendage flattened from above downwards, and forming what is properly termed the fore-foot. Each of these portions present physical lesions. The whole of the posterior portion, which is especially represented by the superior surface of the astragalus, is naturally pressed from above downwards by the weight of the body when the person stands upright. The force which is then represented by the weight of the body is distributed over a large surface, and is decomposed into two other forces, which are transmitted, the one forwards, the other backwards. This decomposition of the force serves to protect the foot, whose resistance is further increased by the arch described by its plantar surface. It is in consequence of this, that in falls from a height on to the sole of the foot, the bones of the foot are capable of affording a successful resistance. Nevertheless, there are cases in which the violence is so great, that notwithstanding the curvature of the foot and the decomposition of the force, fracture takes place. It is the astragalus which first receives the shock and resists the violence. Generally, under these circumstances the astragalus is fractured and crushed, wedged as it is between the tibia, and the fibula, and the calcaneum. More rarely, another condition arises, the astragalus is dislocated: being carried more particularly inwards, it is driven out of its position by the same mechanism as a cherry-stone is propelled to a distance when pressed between the fingers. If in the fall the foot comes flat on the ground, and if the leg is perpendicular to the foot, the bone will be crushed. If, on the contrary, the foot is a little bent, it is more likely to produce a dislocation of the astragalus. Let us see what are the consequences of this dislocation. Isolated on all sides, this short bone presents but little purchase for the action of the hands or of any apparatus; it forces out the skin which is distended, assumes a bluish colour, and is liable to become gangrenous from the application of even slight pressure. There is, therefore, great difficulty in reducing the bone. Is there any advantage in accomplishing it? We do not think there is In fact, the bone having undergone great displacement, is separated from all the tissues which supply it with nourishment; this is almost a certain cause of necrosis, which will occur just the same even if the bone is reduced. It is, therefore, better to remove the bone and bring the foot into connection with the leg Many successful cases have attended this method of treatment. Let us observe, however, that this condition differs entirely from that in which the astragalus is forced through a wound, but still retains its deep connexions with the calcaneum and with the soft parts. In the latter case, the removal of the astragalus is in no way indicated, and the proof of this is that in a case we have mentioned we were perfectly successful without reducing it.

Here then are two of the conditions which are produced by falls, but there are also others which should be considered. Supposing the astragalus does not give way; the force being decomposed in two directions, the posterior will be the most powerful, because it occurs almost entirely in the direction of the principal force, and its action will be exerted on the calcaneum. It is in this way we are able to account for the crushing and fracture of this bone between the ground which forms the resistance and the force from above. We have here supposed that the force acts from above downwards, but the same reasoning will apply to a force acting from below upwards. It may also happen that the force which is transmitted to the fore part of the foot produces fracture of the bones, forming the second row of the tarsus; but this result must be more rare, because the fore part of the foot is curved, and resists on the principle of the arch, and especially because the direction of the force which reaches it is almost perpendicular to the direction of the force producing it, a condition very unfavourable to the power of this force.

The second portion of the foot, that which forms the true appendage of the lower limb, is subject to injuries whose symptoms should be carefully studied. Thus, from its position and direction, the dorsal surface of the foot is constantly exposed to direct violence, such as contusions, wounds of all kinds, crushing, burns, effusion of blood, fractures, &c. It is sufficient to examine the organs situated between the skin and the aponeurosis to obtain a clear insight into these physical lesions. Placed between the external violence and the bones of the tarsus and of the metatarsus, the soft parts are easily lacerated.

In regard to operative surgery, we shall only make a general remark. The skin is delicate and easily separated together with the subjacent tissues, which have no great thickness or large supply of blood-vessels, that is to say, their nutrition is sluggish and they are predisposed to gangrene. In the different amputations of the foot, either partial or entire, it is hardly possible to make use of a skin possessing these characters, because mortification will set in, and the subsequent ulceration destroy or so modify the condition of the parts that the benefits of the operation will be entirely prevented. Surgeons have, therefore, long since taken their flap from the sole of the foot, where the skin possesses all the qualities necessary to resist mortification and the effects of pressure. The only inconvenience of these operations when performed according to Chopart's method, is the necessity of employing in these cases to a great extent, if not entirely, the skin from the dorsal surface of the foot.



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LIBRAIRIE GERMER BAILLIERE

PLATE CII.

Dorsal Region of the Foot.

Deep layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the deep aponeurosis.
D. Section of the tendo Achillis.
E. Serous bursa beneath the tendo Achillis.
F. Section of the serous membrane.
G. Extensor brevis digitorum muscle.
G′. Tendon of the extensor brevis digitorum.
G″, G‴, G⁗. Tendons of the extensor brevis digitorum.
G′′′′′, G′′′′′′. Tendons of the extensor longus digitorum.
H. Tendon of the peroneus longus muscle.
I. Tendon of the peroneus brevis muscle.
I′. Tendinous expansion sent to the little toe by the tendon of the peroneus longus.
J. Insertion of the peroneus tertius.
K. Section of the tendon of the flexor proprius pollicis.
L. Section of the tendon of the flexor communis digitorum.
L′. Section of the tendon of the tibialis posticus muscle.
L″. Section of the fibro-synovial sheath of the tendon of the tibialis posticus muscle.
M. Section of the tendon of the tibialis anticus muscle.
M′. Section of the aponeurotic sheath of the tendon of the tibialis anticus muscle.
N. Section of the tendon of the extensor communis and of the extensor proprius pollicis muscle.
N′. Section of the sheath of the tendon of the extensor communis and of the extensor proprius pollicis muscles.
O. Articular surface of the calcaneum.
P. Anterior articular surface of the calcaneum.
Q. Articulating surface of the cuboid bone.
R. Insertions of the fibres of the extensor brevis digitorum into the calcaneum and into the superior calcaneo-cuboid ligament.
S. Adiposo tissue of the heel.
T, U. Interosseous muscles.
V. Fifth metatarsal bone.
V′, V″, V‴, V⁗. Fourth, third, second and first metatarsal bones.

1. Dorsal artery of the foot.
2. Tarsal branch of the dorsal artery.
3. Branches of the tarsal artery.
4. Metatarsal artery.
5. Interosseous branches of the metatarsal artery.
6. Interosseous artery supplied by the tarsal artery.
7, 8. Interosseous arteries coming from the tarsal artery.
9, 10. Veins accompanying the dorsal artery of the foot.
11, 12, 13. Interosseous veins.
14. Plantar artery.
15, 15′. Veins accompanying the plantar artery.
16. Anterior tibial nerve dividing into two branches an external or tarsal branch and an internal branch.
17. Plantar nerve.
18. Internal branch of the tibial nerve supplying the external collateral nerve of the great toe and the internal collateral of the second toe.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In this Plate it is seen that the astragalus has been removed, in order to illustrate what we have said in the text of the last Plate in relation to fractures of the tarsus. The two articular surfaces of the calcaneum (O, P,) are horizontal, and thus receive almost directly the whole force of any shock, while the articular surface of the cuboid (Q,) only receives it in a horizontal direction, remembering that it has a nearly vertical direction looking backwards. From this arrangement, it follows that in falls upon the soles of the feet the calcaneum will receive a more violent shock and will be more exposed to fracture than the bones forming the fore part of the foot.

Wounds which extend to the tissues of this deep layer are much more serious than those we have considered in the previous Plate. In fact, we have here large arteries, muscles, tendons and nerves, as well as bones and their articulations, which may be more or less extensively wounded. In regard to wounds of the arteries, we may observe that they are very frequent, and also serious. They are frequent, because the arteries are numerous, and they are serious, not only on account of the size of the vessels, but more especially because there is a very free communication between the vessels, which causes the blood to come from the lower end after a ligature has been applied to the upper. Hence, it is useless to recommend the same proceeding here as in the case of the palm of the hand, that is to say, of placing a ligature on the two extremities of the vessel. Nevertheless, if the size and the free anastomosis of the vessels are conditions favourable to hæmorrhage, there is another condition that counteracts this evil; resting as they do upon the bones, the dorsal artery and its branches may be readily compressed, which is one of the most certain means of arresting hæmorrhage. In regard to wounds of the muscles, tendons, or even the nerves, we have no remarks to make, as they present no special peculiarities. Injuries of the joints are very frequent, and are often caused by crushing; when this is the case, all the tissues of the region are involved. These wounds may be successfully treated by cold water dressings.

If the bones of the tarsus, and principally those of the second row, escape fracture on account of their cubical form, it is not so with regard to the metatarsal bones. These bones, five in number, are often fractured, either from a direct or an indirect cause. The displacement in those fractures is none or little, because each metatarsal bone which remains uninjured acts as a splint to that which is fractured. Thus we find these fractures get well without any complicated apparatus. The application of a bandage, with compresses carefully applied, and above all, rest in bed, are quite sufficient to secure a regular union.

There is nothing special to be said in regard to the vital and the organic lesions of this region. Inflammations, fistulæ, cancer, and white swelling are of frequent occurrence, but offer no peculiarities.

In regard to operations, we have some important remarks to offer. Thus, with regard to Lisfranc's or the tarso-metatarsal disarticulation, the projection formed by the posterior extremity of the fifth metatarsal bone, which is below the line G, should be noticed. This extremity serves as a guide by which to direct the knife in the course it should take. Internally, there is greater difficulty in finding the guiding point, but at the same time it is not insurmountable. The projection which serves as our guide is not visible through the skin, but it may be found by the following plan. The middle or index finger, or both of them, are applied to the inside of the first metatarsal bone; we carry them along this surface from before backwards, and at length feel beneath them a projection, which is the posterior extremity of the first metatarsal bone. If this plan does not succeed, as may happen in fat persons, the following may be advantageously employed. Two fingers of the left hand are placed opposite the head of the first metatarsal bone, while with the right hand we move the metatarsal portion of the foot. We soon recognise the position of the articulation. When in this way we have obtained the extreme points of the tarso-metatarsal articulation, we apply the palm of the hand to the plantar surface of the foot, and place the index finger and the thumb on the two points that are to serve for our guides. The interarticular line has a general direction, which passes obliquely from without inwards and from behind forwards.

With regard to the disarticulation of the fifth metatarsal bone, we seek in the same way for its posterior extremity, and have recourse to the semicircular method, which has the great advantage of preserving the skin of the plantar surface. The operation when performed in this manner is simple and elegant. We shall not stop to describe the disarticulations and resections of each of the metatarsal bones. We will, however, say a word upon ligaturing the dorsal artery of the foot. The artery is deeply placed below a double layer of aponeuroses between the innermost fibres of the extensor brevis digitorum and the tendon of the extensor longus pollicis. These are precisely the two points of reference which guide the surgeon when he applies a ligature. The course of the vessel is represented by an imaginary line, commencing at the middle of the intermalleolar space, and passing obliquely from without inwards and from behind forwards.

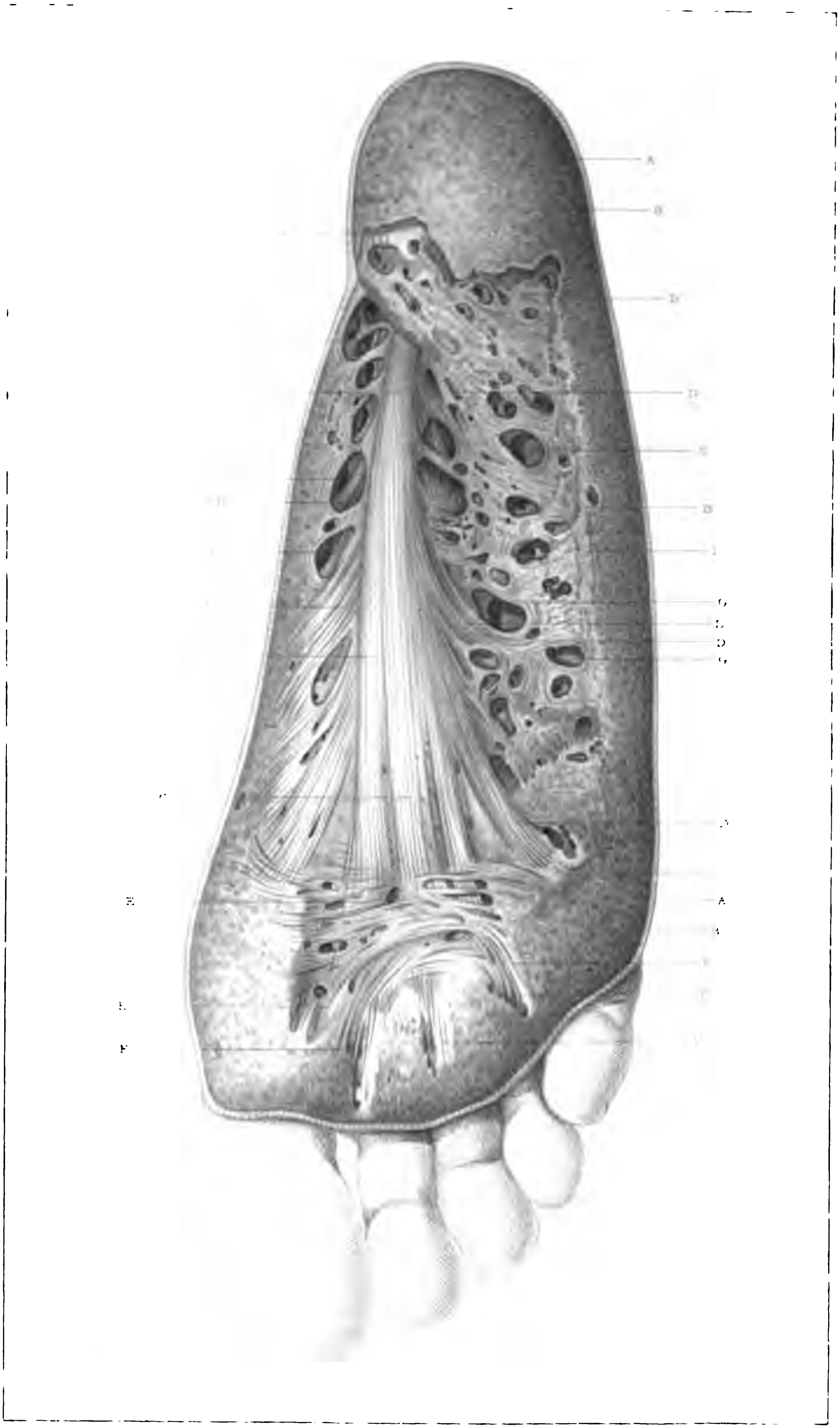
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PLATE CIII.

Plantar Region.

First layer.

EXPLANATION.

A. Section of the skin bounding the region.

B. Subcutaneous fatty cellular tissue.

B′, B″. Section of the first layer of subcutaneous fatty cellular tissue.

C, C′, C″. Plantar aponeurosis (longitudinal fibres).

D, D′, D″, D‴. Lateral fibres of the plantar aponeurosis blending with the subcutaneous tissue and becoming inserted into the under surface of the skin.

D‴, D⁗. Lateral fibres of the plantar aponeurosis passing to the under surface of the skin, becoming united with the subcutaneous fatty cellular tissue and circumscribing spaces in which the fat is lodged.

E. Transverse fibres of the plantar aponeurosis.

E′. Transverse fibres of the plantar aponeurosis forming curves so as to become longitudinal and follow the direction of the longitudinal fibres of the plantar aponeurosis.

E″. Internal transverse fibres becoming oblique and then longitudinal, so as to follow the course of the longitudinal fibres of the plantar aponeurosis.

F. Superficial longitudinal fibres of the plantar aponeurosis passing to the plantar surface of the toes and forming a canal in which is lodged a nerve belonging to the plantar surface of the toes.

G, G′, G″, G‴. Superficial openings of the spaces bounded by the transverse fibres of the plantar aponeurosis.

H. Deep transverse fibres of the plantar aponeurosis.

H′. Other deep transverse fibres of the plantar aponeurosis.

I. Termination of the superficial transverse fibres of the plantar aponeurosis.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate exhibits the plantar aponeurosis seen from its cutaneous surface, and in connexion with the superficial fascia and the skin of the sole of the foot. It especially shows the structure of the plantar aponeurosis in regard to the fibres which are attached to the base of the dermis throughout the whole of the region. We would call attention to the fibres on each side of the foot, which as they go to the skin form a kind of superficial perforated layer, through the openings of which we see the fibres of the same plantar aponeurosis going to be inserted into the bony prominences on the sides of the foot. We have here, therefore, to point out the surgical applications belonging to the skin, the superficial fascia, and the plantar aponeurosis.

The physical lesions of these organs are of frequent occurrence, this is easily understood when we consider that the soles of the feet support the whole weight of the body, and are constantly in contact with the ground and the various objects upon it which are capable of inflicting wounds. Wounds of the soles of the feet are more common in summer when persons enjoy the pleasures of bathing. They may be situated at any part of the region. Their depth varies, thus sometimes only the epidermis is involved, and the dermis remains intact; there is, so to speak, no wound, since the epidermis does not posses vitality; this is explained by the thickness and consistency of the tissue which is intended to afford an efficient protection to the true skin. Notwithstanding this protection, the dermis is sometimes reached, even when this is the case the edges of the wound have but little tendency to separate, which is explained by the thickness of the epidermis, which does not retract, and by the presence of the fibres of the plantar aponeurosis, which form a kind of natural suture below the dermis and present a strong impediment to the separation of the lips of the wound. The thickness of the epidermis, of the skin, and of the superficial fascia filled with fat hinder wounds of the sole of the foot from reaching the plantar aponeurosis or from passing beyond it, forming in this way a protection to the deep organs, which are the most important in regard to their functions.

In regard to the agents by which wounds are inflicted, they may be pointed, sharp, cutting, blunt, hard, or brittle. Nails, fragments of glass or stone, branches or twigs of trees, often cause wounds on the sole of the foot. Wounds from laceration or from crushing seldom occur except on the dorsal surface. The absence of any large vessels in the layer we are studying, accounts for the small amount of hæmorrhage which accompanies these wounds.

Nevertheless, there is one complication which sometimes follows these wounds, which it is necessary to mention, that is, inflammation and suppuration.

These vital lesions have a special character. If the wound is not carefully attended to, or if the patient continues to walk, inflammation will be set up and extend to the fatty cellular tissue. But the latter tissue confined between the fibres of the plantar aponeurosis cannot easily become distended, and hence there arises the symptoms of a strangulated condition of the part, the same as in carbuncle. Moreover, the skin being covered by a thick epidermis, the severity of the inflammation is not shown by the external redness of the parts; there is, consequently, a certain amount of uncertainty as to its treatment. Let us add that pus will often form in the subcutaneous tissue, and that it easily makes its way through the dermis, but that it cannot do the same with regard to the thick, horny epidermis. The pus will thus form two accumulations, communicating together through a narrow opening in the dermis. The skin of the plantar region is abundantly supplied with all kinds of vessels, and may therefore be the seat of erysipelas or of inflammation of the lymphatics, but these disorders do not reveal themselves to the eye of the surgeon as in other parts. In fact, the redness and swelling can hardly show themselves, because of the anatomical conditions we have already pointed out arising from the presence of the thickened epidermis.

Special organic lesions often occur in this region: we refer to corns, bunions, tumours of the papillæ, and to the disease termed *perforating ulcer of the foot*. The presence of the two first diseases is easily explained In sportsmen, constant walking and friction cause the epidermis to become thickened and hardened; the dermis is thinned and forms a kind of serous or synovial membrane, which facilitates the movements of the kind of foreign body represented by the thickened epidermis. But it may happen that inflammation shows itself beneath the corn which extends downwards and produces an abscess. This abscess generally opens on the skin, but only after a long time, because of the resistance presented by the epidermis. Before it opens, the abscess reveals itself to the surgeon by a dull, yellow, and sometimes reddish colour, as when blood has been effused into the centre. When these symptoms show themselves, an opening must be made for the exit of the pus, either by perforating the epidermis or by softening it by means of alkaline baths. If we permit the abscess to pursue its course, it may extend downwards, and passing through the aponeurosis and subcutaneous tissue reach to the bones or to the articulations. Perforating ulcer of the foot *(le mal perforant du pied)* is sometimes formed in this way.

The cutaneous tissue abounds in papillæ, which give to the sole of the foot that special sensibility which is so necessary for walking. These papillæ are sometimes altered by inflammation and by hypertrophy, forming excrescences whose development is arrested by the epidermis and by the constant compression which necessarily occurs in walking. But, as these papillæ cannot protrude on the epidermal surface, they are driven through the dermis, destroy the aponeurosis, reach the deep organs, then suppurate, and thus give rise to a perforating ulcer of the foot. Here, therefore, is a second mode in which this singular disease may be produced; we shall presently meet with two others.

The plantar aponeurosis itself, like the palmar aponeurosis, is liable to become contracted, and this contraction may be partial or entire. Surgeons have been in the habit of dividing these contracted bands by means of a tenotomy knife, either from the superficial to the deep parts, or *vice versa*. This operation will only be of use when the disease is of recent date.

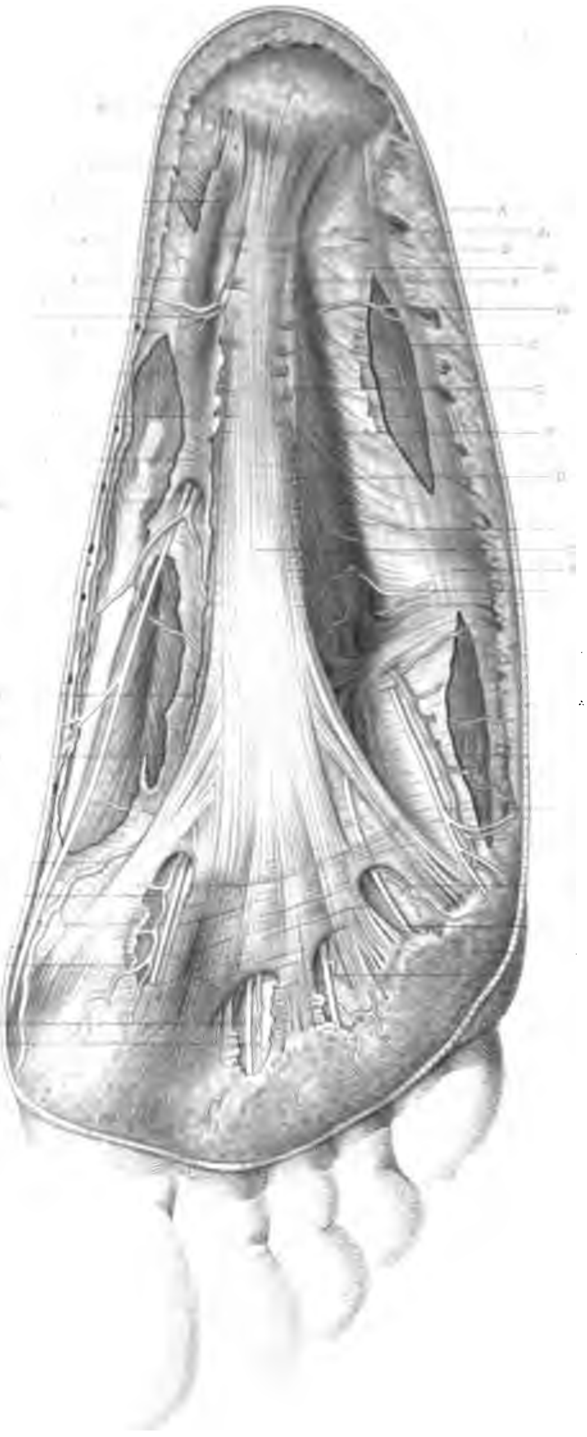
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PLATE CIV.

Plantar Region.

Second layer.

EXPLANATION.

A. Section of the skin bounding the region.

B. Subcutaneous fatty cellular tissue traversed by the lateral fibres of the plantar aponeurosis.

C. Plantar aponeurosis.

D, D′, D″, D‴. Section of the internal and external superficial fibres of the plantar aponeurosis.

E, E′, E″. Internal and external lateral portions of the plantar aponeurosis bounding the cavities or spaces on the sole of the foot.

F. Transverse and oblique fibres strengthening the external portion of the plantar aponeurosis.

G, G′, G″. Section of the plantar aponeurosis to show the muscles contained in the internal and external spaces of the sole of the foot.

1. Cutaneous branch of the internal plantar nerve going to form the dorsal internal collateral nerve of the great toe.

2. Branch of the internal plantar nerve going to ramify on the plantar surface of the toes.

3, 4, 7, 8. Nerves going to form the collateral nerves of the plantar surface of the toes.

5, 6. Cutaneous filaments of the internal plantar nerve.

9, 10, 11. Cutaneous filaments of the internal plantar nerve.

12. Cutaneous artery coming from the internal plantar artery.

13, 14, 15, 17. Branches of the plantar interosseous arteries supplied by the plantar arch.

16. Cutaneous branch from the internal plantar artery.

19. Cutaneous branch from the external plantar artery.

20, 21. Cutaneous branches from the external plantar artery.

22. Artery from the plantar arch going to the dorsal surface of the great toe.

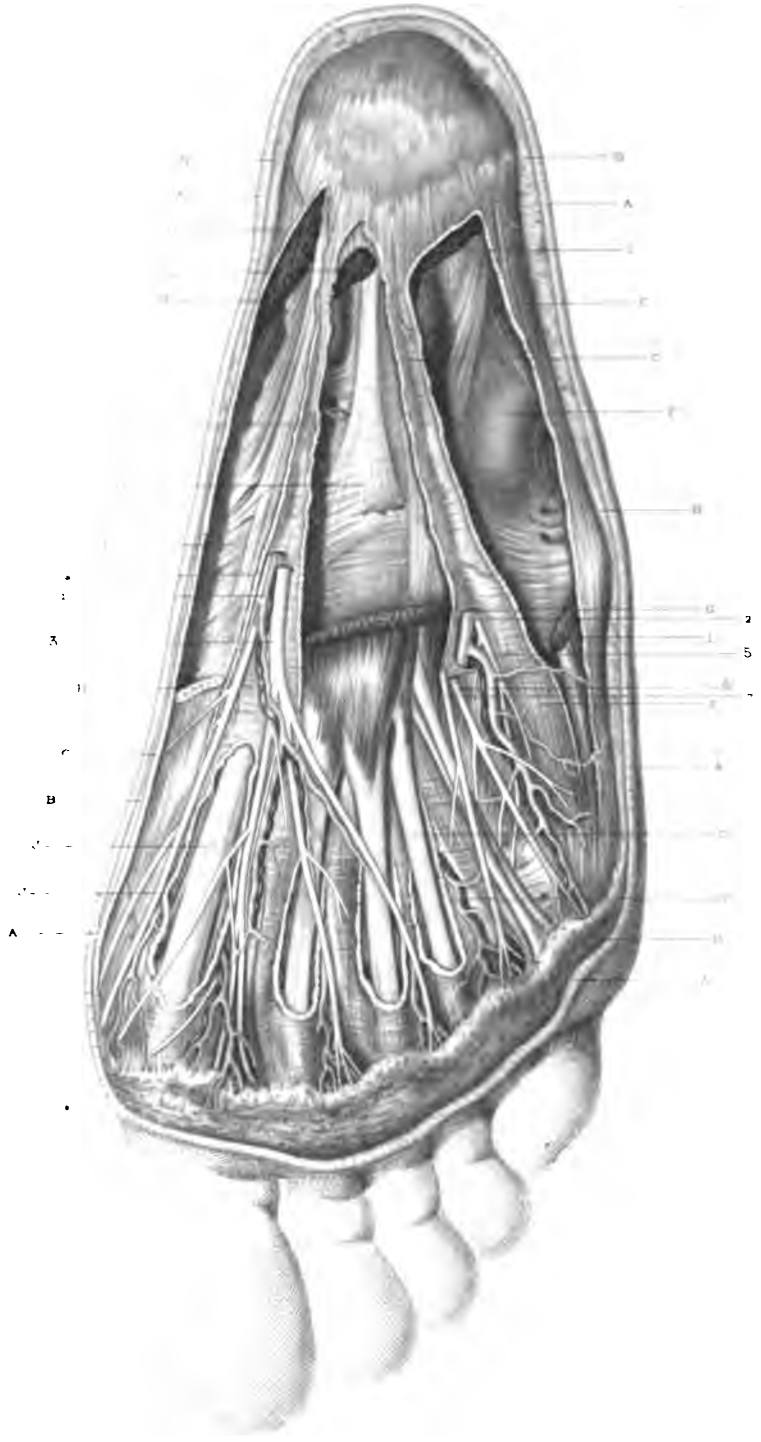
APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate exhibits the deep fibres of the plantar aponeurosis. At D, D, may still be seen the superficial or cutaneous fibres which pass off from each side of the central portion of the aponeurosis to be inserted into the under surface of the skin, forming the fibrous sheaths for the protection of the vessels and nerves which are distributed to the skin (see F, F, Plate CIII.)

In the present Plate there is seen on the inner side of the foot numerous sections of the veins which, passing from the sole of the foot, enter the veins on its dorsal surface. These veins are able to pursue their course in the sole of the foot in consequence of the protection afforded them by the superficial transverse fibres of the plantar aponeurosis. It is also seen in this Plate that at the middle part of the foot, where the protection ought to be greatest, the aponeurosis forms a thick membrane of compact tissue, composed principally of the longitudinal fibres, but strengthened by the transvere fibres which go to the skin. At the sides, the aponeurosis, although thinner, is still very strong, and is inserted into the bony prominences at the edge of the foot. This aponeurosis thus forms sheaths for the muscles going to the great and little toes. For the passage of the vessels and nerves going to the skin and the subjacent parts, the aponeurosis presents openings of an arched form, from whose circumference aponeurotic fibres are given off, which accompany and protect these important organs. It is unnecessary to point out the utility of such an arrangement in maintaining the circulation and nutrition of the region during locomotion.

In regard to the physical lesions, such as wounds from cutting instruments, the arteries which become superficial can hardly give rise to such an amount of hæmorrhage as to cause any alarm. In fact, at the back part of the region there are only small branches. At the middle there are larger vessels (17 and 21,) which might produce hæmorrhage; but being placed between two resisting layers, these vessels are easily compressed. Numerous nerves are met with between the aponeurosis and the skin; it is hardly possible to suppose that any wound, even one made by a pointed instrument, will not involve some one of these nerves. Hence it is that these wounds are sometimes followed by tetanus. We have been assured that in hot climates even the smallest wounds are almost sure to be followed by this terrible complication.

We have previously said that the plantar aponeurosis forms contractions in the same manner as the palmar aponeurosis. It must, however, be admitted that this complication is very rare, since Phillip Boyer could say that in the space of fifteen years he had only known one instance, and that one recorded by Sir Astley Cooper. Boyer says he has often seen the toes bent upon their under surface, a condition which forms a great impediment in walking, but there was no transverse folds, showing, as in the case of the hands, that the aponeurosis itself had contracted. The case mentioned by Sir Astley Cooper was one in which his nephew, Mr. Bransby Cooper, had divided the band in the foot of a farmer for a contraction similar to that which occurs in the fingers, and which prevented him from following his usual occupation. This proves that this retraction is not common, and that it is, therefore, desirable to call the attention of surgeons to this point of pathology.



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LIBRAIRIE GERMER BAILLIÈRE

PLATE CV.

Plantar Region.

Third layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty fibro-cellular tissue.
C. Plantar aponeurosis.
D. Middle compartment containing the flexor brevis digitorum muscle.
E. Internal compartment containing the abductor pollicis muscle.
F. External compartment containing the abductor minimi digiti muscle.
G. Section of the flexor communis digitorum.
G′. Tendons of the flexor brevis digitorum contained in a fibrous sheath.
G″. Fibrous sheath laid open containing the flexor muscles of the toes.
H, H′. Section of the tendon and of the flexor brevis digitorum.
I. Section of the tendon of the abductor minimi digiti muscle.
J. Tendons of the flexor communis and of the flexor proprius pollicis muscles.
J′. Opening in the fibrous sheath containing the tendons of the flexor communis and of the flexor proprius pollicis muscles.

1. Cutaneous and subcutaneous artery coming from the internal plantar artery.
2. Trunk of the external plantar artery furnishing the plantar interosseous arteries.
3. Terminal branch of the internal plantar nerve.
4. Cutaneous nerve coming from the internal plantar nerve.
5, 6, 7. Terminal branches of the external plantar nerve going to form the collateral nerves of the little toe.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

Even a superficial examination of this third layer of the plantar region is sufficient to impress us with the far greater danger which attends its physical lesions. There are, in fact, in this layer various important organs. Thus, for instance, the nerves supplying the collateral branches to the toes may be divided as well as the arteries which accompany them. It is, however, seen that these vessels are of such a size that the hæmorrhage they produce will not be very formidable. What especially renders wounds of this region dangerous is the laying open of its serous bursæ and of its tendinous sheaths. The serous bursæ occupy three principal points, that is to say, the three points which serve to support the foot. They are situated beneath the skin, opposite the calcaneum, and beneath the anterior extremity of the first and of the fifth metatarsal bones. Lenoir has the merit of having first described these bursæ, and of having shown how they may become inflamed, suppurate, and sometimes become fistulous. They are very distinct in persons who are in the habit of walking much, or of standing, but in young or old persons who have not been subjected to these conditions, it is difficult to find them from their being in a rudimentary condition. Very often we have not succeeded in finding them, and in the present instance we have been unable to represent them in consequence of their entire absence. However this may be, it is desirable to bear in mind the possible existence of these bursæ in regard to the interpretation of symptoms, and more especially in respect to therapeutics. Additional synovial bursæ sometimes form opposite a natural or abnormal eminence, and these bursæ may be the seat of inflammation, abscess and fistula. Certain varieties of open wounds may be connected with the inflammation, suppuration, or ulceration of these synovial bursæ.

An opening in the sheath of any of the tendons is dangerous, because the inflammation which follows may extend and reach the deep sheaths of the foot. In penetrating a sheath the instrument may divide the tendon of the flexor of the toes. If this lesion exists, the tendon of the extensor of the toes soon carries the corresponding toe into an exaggerated condition of extension, which must be overcome from the commencement by maintaining the toe, by means of a suitable apparatus, in a permanent state of flexion. If the wound is situated behind, it will not be so serious, because there we only meet with muscles which are protected by powerful aponeurotic septa.

Abscesses situated in this layer may be naturally divided into three varieties, according as they occupy one of the three compartments. Those of the middle layer are the most serious, because they are difficult to diagnose and to treat. In fact, the pus which forms in the middle compartment will be retained on all sides by the thick fibrous septa. It is only after a considerable time that it will make a way for itself towards the anterior part of the region, from whence it passes more easily to beneath the skin through the natural openings of the plantar aponeurosis.

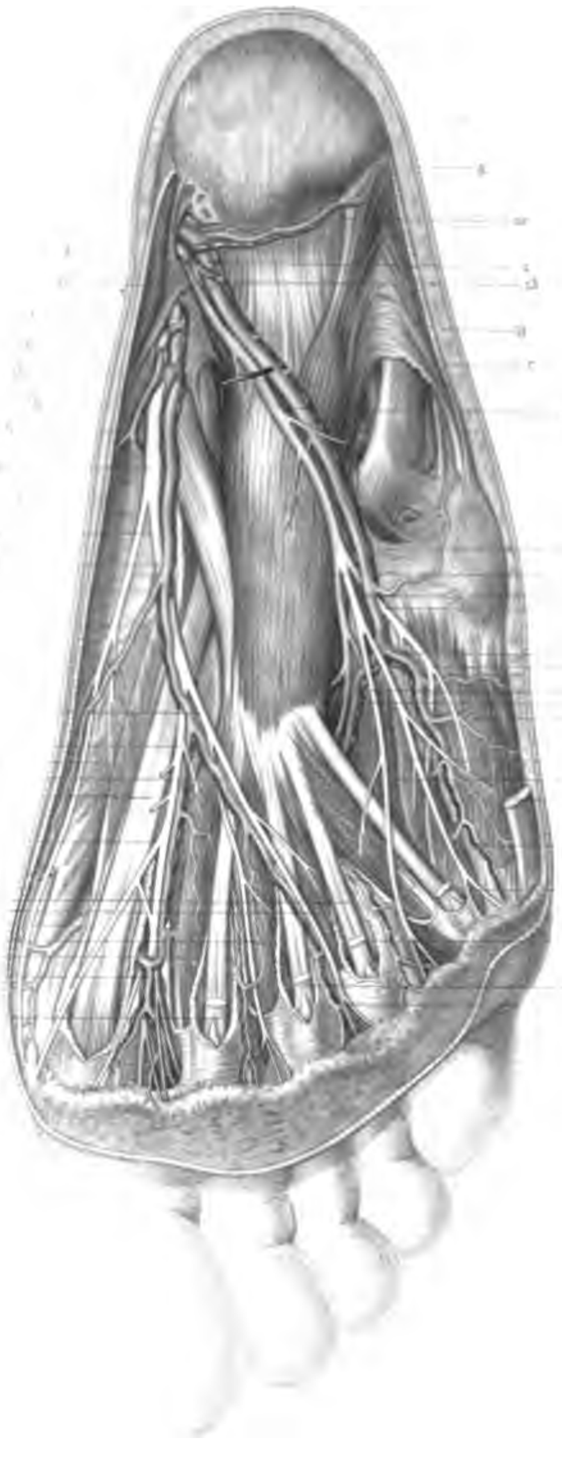
The greater thinness of the plantar aponeurosis at the sides causes an abscess of the internal or external compartments to open more speedily on the skin. We have seen a white swelling of the articulation of the fifth metatarsal with the cuboid bone give rise to an abscess which opened in a very short time at the side of the sole of the foot. All these abscesses have a common tendency, that is, of easily producing fistulæ. This character belongs to them in consequence of their being situated in the midst of various tissues, divided by septa, forming various layers, which cause the passage of the pus from one point to another to be retarded. Hence the principle of opening quickly and freely any accumulation of pus in the plantar surface of the foot, whatever may be its anatomical seat.

Amongst the vital lesions of this region should be mentioned rheumatic and neuralgic pains, diseases whose situation is easily explained by the presence of fibrous tissues of all kinds, and of the ramifications of numerous nerves. Rheumatism often affects the region of the calcaneum, while neuralgia manifests itself more frequently towards the anterior part of the region.

Towards the anterior part of the foot are numerous sheaths of tendons which produce there all the diseases proper to these sheaths, such as dropsy, foreign bodies, inflammation, fistulæ, and fungous growths, all of them diseases which might for a time assume the characters attributed to a perforating ulcer of the foot *(mal perforant du pied)*.

We shall say nothing of the organic diseases, such as cancer, melanosis, lipoma or cysts, which here exhibit the same characters as in other parts.

With regard to operations, we may observe that those which are performed at the posterior part of the region are less dangerous, other things being the same as those which are performed at the anterior part. Let it be understood that in speaking of operations, we refer to punctures and incisions that do not pass beyond the layer we have before us.



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LIBRAIRIE GERMER BAILLIERE

PLATE CVI.

Plantar Region.

Fourth layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the fatty subcutaneous cellular tissue.
C. Section of the plantar aponeurosis.
D. Deep surface of the plantar aponeurosis.
E. Section of the tendon of the abductor muscle of the little toe.
F, F′, F″, F‴. Section of the tendons of the flexor brevis digitorum.
G. The flexor accessorius muscle attached to the tendon of the flexor longus digitorum.
H. Tendon of the flexor longus pollicis muscle.
I. Flexor brevis minimi digiti muscle.
J, J′, J″, J‴. Lumbricales muscles.
K. Internal fibres of the flexor minimi digiti muscle.
K′. External fibres of the oblique abductor muscle of the great toe.

1. External plantar artery.
2. External interosseous branch of the external plantar artery.
3. Middle interosseous branch of the external plantar artery.
4. Recurrent articular branch furnished by the external plantar artery.
5. Internal plantar artery.
6. Internal cutaneous branch furnished by the internal plantar artery.
7, 8, 9. Interosseous branches furnishing the collateral arteries of the toes.
10. Arterial branch going to the skin and to the dorsal surface of the great toe.
10′. Recurrent calcaneal branch of the external plantar artery.
11. Interosseous branch resulting from the anastomosis of the plantar artery and of the internal dorsal artery.
12. Interosseous branch of the fourth space formed by the anastomosis of the plantar artery and the metatarsal artery.
13, 13′. Plantar veins accompanying the external plantar artery.
14, 15. Vein accompanying the interosseous arteries of the external plantar artery.
16. Veins accompanying the internal plantar artery.
17. External plantar nerve.
18. External terminal branch of the external plantar nerve.
19. Muscular branch of the terminal branch of the external plantar nerve.
20. Deep terminal branch of the external plantar nerve.
21. Internal plantar nerve.
22. Internal collateral plantar nerve of the great toe.
23. External branch of the internal plantar nerve furnishing the collateral nerves of the toes.
24, 25. Nervous branches giving off the collateral nerves of the first four toes.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

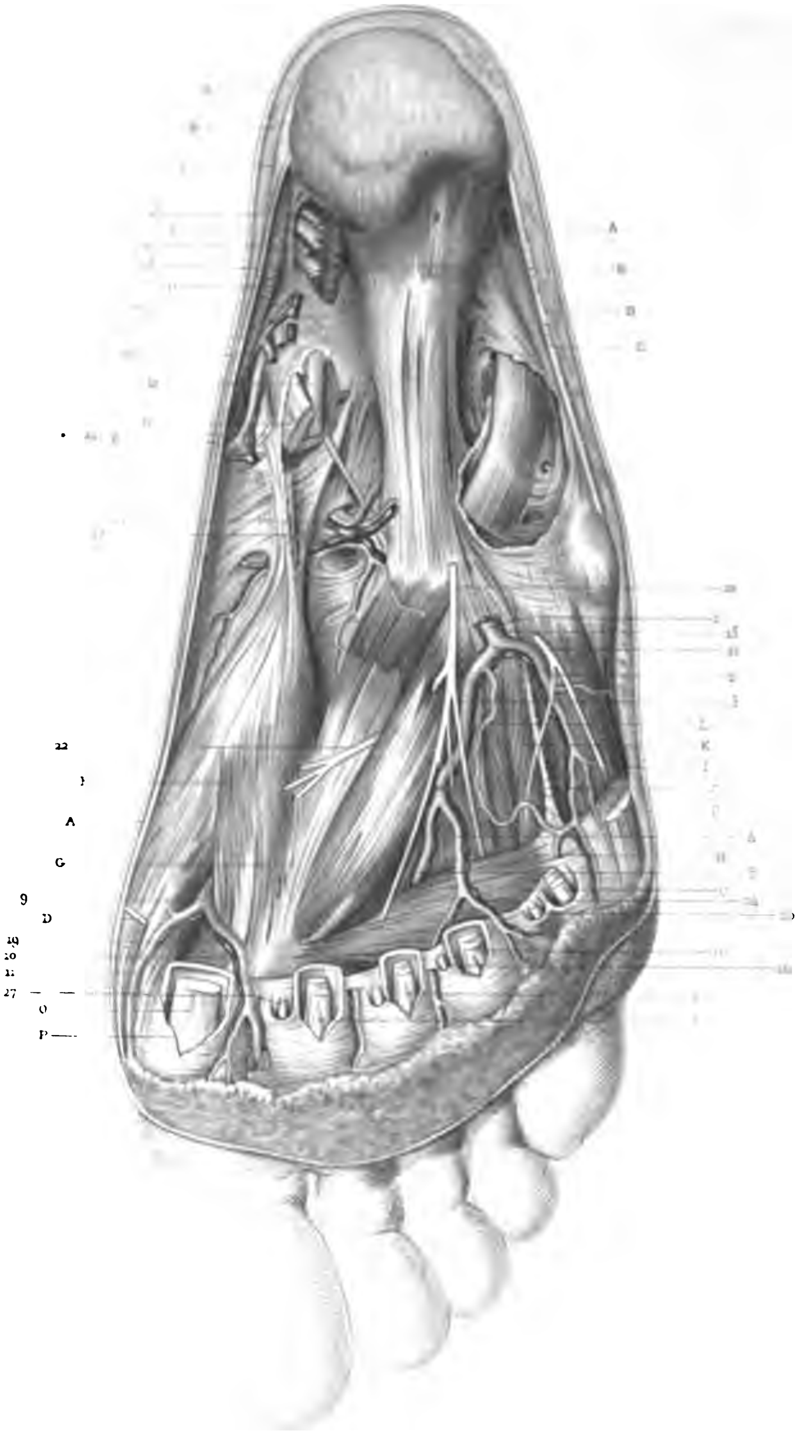
It is sufficient to look at the present Plate to understand all the danger of those wounds of the plantar region which extend to this fourth layer. Muscles, tendons, sheaths of tendons, synovial membranes, articulations, bones, arteries, veins and nerves, all of them organs of great importance, may be wounded.

Wounds of the plantar artery and of its branches are the most dangerous, and the danger is greater in proportion as the wound is situated towards the posterior part of the region. It is easily understood that this arises from the greater size of these vessels towards their origin. With regard to the diagnosis of wounds of these arteries, this is principally established upon our anatomical knowledge of their direction. Thus, whenever a deep wound is situated near the inner border of the foot, about one centimetre (·3937 English inch) distant from this border to the posterior extremity of the first metatarsal bone, if the bleeding was profuse we should diagnose a wound of the internal plantar artery. If the wound is situated on a line which, commencing from the internal border of the heel impinges obliquely on the posterior extremity of the fifth metatarsal bone, we are almost certain that the external plantar artery is involved. If the wound is situated beyond a transverse line joining the posterior extremities of the fifth and first metatarsal bones, the danger of hæmorrhage, although still present, will nevertheless be much diminished, because in the whole of the space included between this line and the toes the arterial ramifications are only of secondary importance.

Moreover, when there is a wound in the sole of the foot, the conduct which the surgeon should pursue is indicated by the anatomical arrangements of the region; if the wound is large and gaping, he should avail himself of this to seek for the divided artery and apply a ligature to its two extremities. But these conditions seldom occur, and it is a principle of good surgery not to waste our efforts in seeking for the extremities of the vessel, because most frequently the narrowness of the wound, the quantity of blood, and the depth at which the vessel is placed, are all opposed to the success of the attempt. If the attempt is hopeless in the case of a recent wound, much more must it be so in the case of secondary hæmorrhage, when the wound will have become obstructed by the growth of new flesh. What course must, therefore, be pursued? We must at once decide to ligature the posterior tibial artery behind the internal malleolus, according to the rules we have previously given. But we must not conceal from ourselves that this ligature alone is not an absolute guarantee against the return of the hæmorrhage, and does not always arrest it. The following is the reason of this: at the anterior part of the present Plate it is seen that there are very large anastomoses between the dorsal and plantar vessels, by means of which the blood may be conveyed to the inferior extremity, and even to two extremities of the divided vessel. To render the operation secure, it is, therefore, necessary to apply a second ligature to the dorsal artery of the foot. We should not have recourse to this second ligature, excepting in cases where it is clearly seen that the first is insufficient; for this reason it is desirable to allow a short interval to elapse between the two operations.

At first it would appear that compression, assisted by the perchloride of iron, would enable us to dispense with this double operation. We will state distinctly our views on this matter. If we have admitted the usefulness of compression in regard to the hæmorrhage arising from wounds which do not extend beyond the plantar aponeurosis, we do not admit it in respect to the hæmorrhage which accompanies wounds below the aponeurosis. In fact, in order that compression should be successful in the latter case, it would be necessary to depress the plantar aponeurosis. But anatomy and physiology teach us that this depression is impossible. With regard to the perchloride of iron, we are afraid of the dangers to which it exposes the sole of the foot, because it always produces a long and profuse suppuration. We ought at all cost to avoid extensive and deep cicatrices in the sole of the foot, if we hope to preserve the power of walking with facility and without pain.

Vital lesions, such as inflammation and suppuration, deserve our attention. Inflammation may attack any of the organs belonging to the region; but the tendinous sheaths of the long and accessory flexor muscles, and of the tendon of the peronæus longus, are the most liable to this lesion, which, in consequence of the depth at which the organs are placed, frequently passes unnoticed. We have already mentioned, when speaking of the preceding Plate, the way in which abscesses that are beneath the plantar aponeurosis may establish an external opening



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LIBRAIRIE GERMER BAILLIÈRE

PLATE CVII.

Plantar Region.

Fifth layer.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C, C′. Section of the plantar aponeurosis.
D. Section of the adductor muscle of the great toe towards its posterior insertion.
E. Section of the flexor accessorius muscle.
F. Flexor brevis pollicis.
G. Abductor obliquus pollicis muscle.
H. Abductor transversus pollicis muscle.
I. Flexor brevis minimi digiti.
J. Fibrous band giving insertion to the abductor transversus pollicis and separating the short flexor of the little toe and the plantar interosseous muscle of the fourth space.
K. Last plantar interosseous muscle.
L. Last dorsal interosseous muscle.
M. Section of the tendon of the flexor longus pollicis.
N. Section of the tendon of the flexor communis digitorum.
O. Section of the tendons of the flexor muscles of the great toe.
P. Section of the tendon of the abductor muscle of the little toe.
Q, R, S, T. Section of the tendons of the flexors of the toes.

1. Trunk of the external plantar artery.
2. External branch of the external plantar artery.
3. Deep branch of the external plantar artery.
4. Interosseous branch of the external plantar artery.
5. Perforating branch of the external plantar artery anastomosing with the metatarsal artery.
6. Trunk of the external plantar artery.
7. Trunk of the internal plantar artery.
8. Internal cutaneous branch of the internal plantar artery.
9. Perforating branch coming from the dorsal artery of the foot.
10. Trunk forming the plantar collateral arteries of the first and second toes.
11. Internal collateral artery of the great toe.
12. Deep articular artery.

13, 14. Veins accompanying the ramifications of the external plantar artery.
15. Veins accompanying the external plantar artery.
16, 17. Veins accompanying the internal plantar artery.
18. Deep articular veins.
19. Veins accompanying the perforating artery.
20. Deep branch of the external plantar artery.
21. External branch of the external plantar nerve.
22. Deep muscular branch of the external plantar nerve.
23. External plantar nerve.
24. Internal plantar nerve.
25, 26, 27. Section of the tendons of the lumbricales muscles.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

The physical lesions of this fifth layer are not so dangerous as those of the previous layer. The principal vessels of the region are more superficial, and those we meet with are of less importance. The organs which are liable to be wounded are, the adductor, abductor and interosseous muscles, the sheaths of the flexor muscles, that of the peroneus longus muscle, some branches of the external plantar artery, and those of the dorsal artery which, passing through the first interosseous space, are distributed to the plantar surface of the great toe. None of these wounds are in themselves dangerous, but in order that they may happen it is necessary that the superficial layers should have been passed through, and it is rather in the injury done to the organs in the more superficial layers in which the danger of these wounds consists. The distribution of the dorsal artery on the inferior surface of the great toe, on the inner side of the second toe, and on the part close to the vein of the great toe, suggests the following remark. If a wound reaches this part and hæmorrhage ensues, it is not the posterior tibial but the dorsal artery of the foot which should be tied. It is in anticipation of these anomalies, which are not uncommon, that the careful surgeon always previously compresses the vessel he is about to tie, in order to judge what will be the effects of applying a ligature to it.

Abscesses which occur in this layer are always very slow in showing themselves by physical signs. If they are situated at the posterior part below the bones of the tarsus, they may make their way to the surface through the aponeurosis, and this is what usually takes place after a longer or shorter period, but it may happen that the abscess opens into one of the numerous sheaths which come from both sides of the foot. It is by entering the sheaths of the flexor muscles and of the posterior tibial muscle that the abscess may show itself on the inner side of the tibio-tarsal articulation, or on the external side of the same articulation by following the course of the sheath of the peroneus longus muscle. The converse of this sometimes occurs, that is, an abscess in the region of the ankle or of the lower part of the leg spreads to the sole of the foot through the sheaths of the muscles that have just been mentioned.

There is one disease, dropsy of the sheath of the peroneus longus, which, it would seem, must necessarily extend into the sole of the foot. We have already stated that a band sometimes forms a separation between the peroneal and plantar portions of this sheath. But even where this separation does not exist, we do not find that the dropsy exhibits itself in the sole of the foot in the form of a tumour similar to that which is seen on the outer malleolus. This, no doubt, depends upon the sheath being surrounded on all sides by a strong fibrous tissue, which prevents its distension and the production of even a slight swelling.

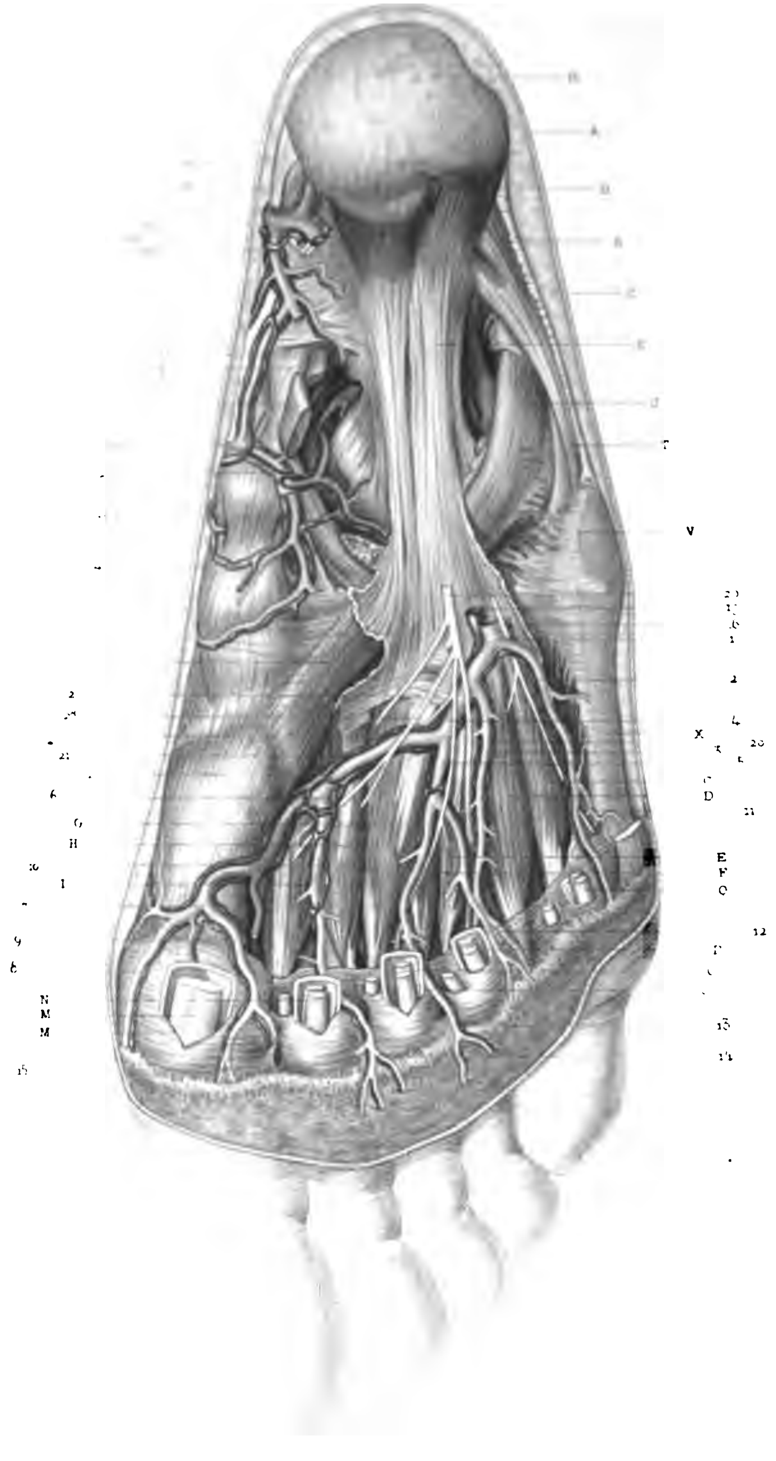
With regard to this tendon, or rather those tendons which pass from the leg to the plantar surface of the foot, it is necessary we should explain ourselves in regard to the part they perform in club-foot. M. Duchenne, of Boulogne, has of late years put forth views which we believe to be correct, and which we shall endeavour to reproduce. No muscle directly extends or bends the foot; these movements can only be produced by a combined muscular action. For extension, there is the biceps muscle, which is both an extensor and an adductor, and the peroneus longus, which is at the same time an abductor. The long flexor of the great toe and the flexor communis digitorum only act as feeble auxiliaries in the extension of the foot. For flexion, there is an adductor flexor (tibialis anticus), and an abductor flexor (extensor longus digitorum). M. Duchenne further proves that the triceps cruris is an extensor and an adductor of the foot, and at the same time impresses a movement of eversion upon its external edge, while the peroneus longus co-operates with the triceps in regard to extension, but becomes its antagonist as regards abduction.

But acting in combination, these two muscles directly extend the foot by opposing its lateral movements. When the peroneus longus acts alone, it produces a kind of tortion, or rolling up of the fore-foot, which diminishes its transverse diameter and hollows the plantar surface. If there is paralysis or atrophy of the triceps cruris, the peroneus longus becoming the principal agent in extending the foot, the depression which the force of the latter muscle produces of the first metatarsal bone, of the first cuneiform bone, and of the scaphoid upon the astragalus, tends constantly to exaggerate and increase the plantar arch, the foot becomes gradually more curved on its inner half, and then the fore-foot becomes bent upon the hind-foot. The calcaneum and the astragalus, far from following the extension of the fore-foot, gradually perform an inverse movement; the heel being no longer retained by the tendo Achillis, becomes depressed, a condition which increases the hollow of the foot, of which the inner border is inclined; lastly, the calcaneum takes the position it has in talus. We have, then, a variety of talipes varus described by M. Duchenne under the name of the hollow foot of the peroneus longus, *(pied creux du long peronier latéral)*.

The permanent inflexion of the foot causes all the muscles and tissues to be in a constant state of retraction; but this retraction, as well as that of the plantar aponeurosis, is only consecutive, and it is from error that up to the present time the effect has been mistaken for the cause in attributing club-foot to the retraction of these muscles and of the plantar aponeurosis.

We must not confound the hollow foot of the peroneus longus, the hollow foot twisted outwards, with the hollow foot twisted inwards of the flexor longus digitorum, nor with the direct hollow foot *(pied creux direct)*, produced by the simultaneous action of these muscles. These three forms of the hollow foot which are observed in talus are also seen in equinus. Atrophy or paralysis of the interosseous muscles produces curving of the foot without increasing the plantar arch.

When, on the contrary, the peroneus longus is paralysed, we observe that the plantar arch becomes diminished and disappears, so that when the foot rests upon the ground, its inner border is applied to it throughout its entire length. In standing, the foot has the same attitude as in valgus, and in extending the foot it takes the attitude it has in varus; in abduction the first metatarsal bone does not rest firmly on the ground; and lastly, the person is unable to balance himself when he elevates the point of the foot. At the same time that the plantar arch becomes obliterated, the projection of the internal malleolus is increased, and ultimately we have the condition of the flat-foot arising accidentally *(un pied plat accidentel)*. M. Duchenne attributes certain cases of *congenital flat-foot* to the want of action in this muscle.



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LIBRAIRIE GERMER BAILLIÈRE.

PLATE CVIII.

Plantar Region.

Sixth layer.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the plantar aponeurosis.
C, D. Dorsal and plantar interosseous muscles of the fourth space.
E, F. Interosseous muscles of the third space.
G, H. Interosseous muscles of the second space.
I. First dorsal interosseous muscle.
J. Tendon of the peroneus longus.
J′. Fibrous sheath of the peroneus longus.
J″. Insertions of the tendon of the peroneus longus into the inferior surface of the posterior extremity of the first metatarsal bone.
K. Section of the flexor longus pollicis.
L. Section of the tendon of the flexor longus digitorum.
M. Tendons of the flexors of the great toe contained in their fibrous sheath.
M′. Section of the fibrous sheath of the tendons of the flexors of the toes.
N, O, P, Q. Tendons of the flexors of the toes.
O′. Opening in the sheath of the flexor tendons of the middle toe.
R. Inferior surface of the calcaneum.
S. Inferior calcano-cuboid ligament, whose anterior and internal fibres serve as a fibrous sheath to the tendon of the peroneus longus.
T. Fibrous band passing from the calcaneum and going to be inserted into the posterior extremity of the fifth metatarsal bone forming a fibrous arch for the passage of the tendon of the peroneus longus.
U. Fibrous arch for the passage of the tendons of the flexor muscles of the toes.
V. Posterior extremity of the fifth metatarsal bone.
X. Body of the fifth metatarsal bone.
Z. Posterior extremity of the first metatarsal bone.

1. External plantar artery.
2. External branch of the external plantar artery.
3. Interosseous branch furnished by the deep branch of the external plantar artery.
4. Deep branch of the external plantar artery.
5. Interosseous artery furnishing the collateral arteries to the plantar surface of the toes.

7. Terminal divisions of the external plantar artery.
8. Internal dorsal collateral artery of the great toe.
9. Trunk of the plantar collateral arteries of the great toe.
10. Interosseous artery of the second space.
11. Artery supplying the collateral arteries of the little toes.
12. Another artery going to the little toe and to the fourth toe.
13, 14, 15. Bifurcations of the interosseous into the collateral arteries.
16. Anastomosis of the internal plantar artery.
17. Trunk of the external plantar artery.
18. Deep articular branch of the internal plantar artery.
19. Vein accompanying the external plantar artery.
20. Small vein going to empty itself into the external plantar.
21. Veins accompanying the deep branch of the external plantar artery.
22. External plantar veins.
23, 24. Veins accompanying the internal plantar artery and anastomosing with the subcutaneous veins of the internal portion of the foot.
25. Deep branch of the external plantar nerve.
26. External branch of the external plantar nerve.
27, 28. Muscular branches of the deep branch of the external plantar nerve.
29. Section of the external plantar nerve.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Plate shows the organs which are in contact with the bones, and the applications referring to them are the same as those we have mentioned in the preceding Plate. We would call the attention of anatomists, and especially of surgeons, to the arrangement and distribution of the external plantar artery, an arrangement and distribution which differs greatly from what we have seen in Plate CVII. In fact, while in the latter Plate the dorsal artery terminates on the plantar surface of the great toe, in the one we have before us it is the external plantar artery which comes to this part. We thus meet with two conditions which it is necessary to remember in practice in regard to hæmorrhages and the application of ligatures.

With regard to the distribution of the artery and the great vascularity of the toes, we would observe that the little toe receives the smallest number of vessels, and its arteries are relatively smaller. This is the reason why in old persons attacked with gangrene (improperly termed *gangrena senilis*, since it may also affect young persons and adults), it is always at the little toe that this dangerous disorder commences.

The foot is liable to certain malformations, which we ought briefly to notice. We refer to club-foot *(talipes)*. The following varieties of this malformation are mentioned: *talipes equinus*, *talipes calcaneus*, *talipes valgus*, and *talipes varus*. In talipes equinus, the astragalus is more or less displaced forwards; sometimes it is even dislocated; the articular portion of its pulley is deformed by the mortise-like surface of the tibia; the other becomes rough and irregular. The bones of the tarsus and of the metatarsus are separated at their dorsal surface, the dorsal ligaments are elongated, while, on the contrary, the plantar ligaments are shortened and thickened.

In talipes calcaneus, a very rare variety, the mortise of the tibia rests upon the neck of the astragalus, and upon the anterior part of its pulley, of which more than half can be felt in front of the tendo Achillis. The base of support rests exclusively upon the calcaneus. In one case, Delpech found the tibialis anticus, the two extensors, and the three peroneal muscles shortened and incapable of extension.

In talipes varus, or where the foot is turned inwards, the anterior half and the external edge of the pulley of the astragalus are no longer covered by the tibia, the astragalus presents a semi-luxation outwards. The cuboid partly leaves its articulation with the os calcis, and the scaphoid leaves three-quarters of the head of the astragalus exposed.

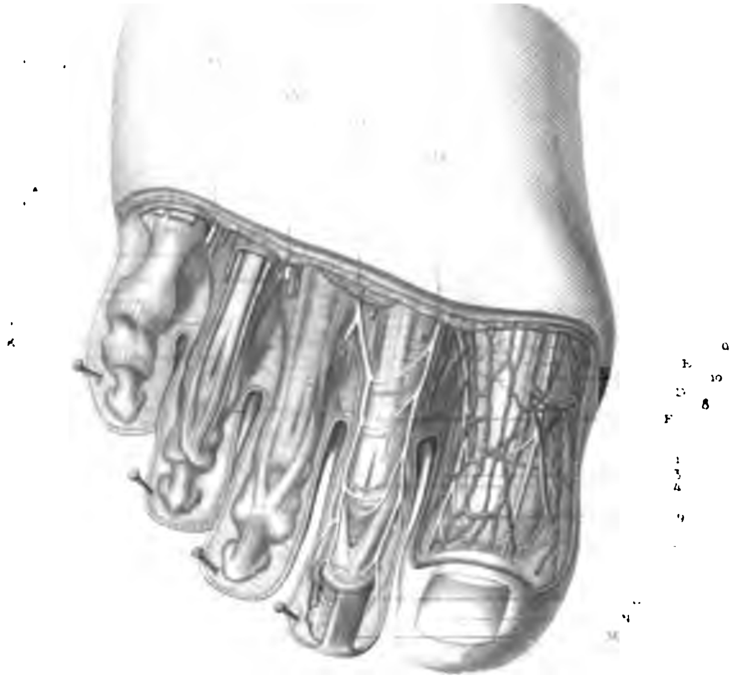
The cuboid, the scaphoid and the astragalus are turned upon their short axis from without inwards. The tibial muscles are shortened.

In talipes valgus, or where the foot is turned outwards, the scaphoid glides over the external side of the astragalus, the latter is lowered so that one part of the head becomes subcutaneous, the cuboid leaves the os calcis internally, and the second cuneiform bone is sometimes flattened.

The under surface of the skeleton of the foot shows how powerful are the ligaments, not only which unite the two portions of the foot, but also each individual bone. These ligaments are more powerful than those on the dorsal surface, and it is for this reason that in partial disarticulations of the foot it is most advantageous to commence with the articulations where they are weakest, that is, on the dorsal surface. By commencing with an articulation on this side, however irregular it may be, the subsequent division of the plantar ligament is very easy. The strength of the ligament on the plantar surface readily explains why the dislocations of these bones, and especially of the metatarsus and of the tarsus, are extremely rare.

Of late years, operations for the partial disarticulation of the foot have been brought to great perfection, and some surgeons have wished to adopt these operations exclusively, rejecting entirely amputations in the length of the bones which form this part of the skeleton. In our opinion, this is evidently an exaggerated view, and that there are cases in which amputation through the bones of the metatarsus possesses undoubted advantages, amongst which we may more especially mention that of preserving a larger portion of the foot.

In regard to partial disarticulations of the foot, we would observe that the synovial membrane lining the articulation of the scaphoid with the three cuneiform bones penetrates between the two first of these bones, and communicates with that belonging to the tarso-metatarsal articulation. Its extent and the number of its processes appeared to Blandin a sufficient reason for always preferring the medio-tarsal disarticulation termed *Chopart's disarticulation*, to that of the metatarsus. In our opinion, in every case the operation of Lisfranc is to be preferred to that of Chopart, because the first offers the same chances of success, and, moreover, has the great advantage of enabling the person to stand, and renders walking more easy from the foot having a much greater length.



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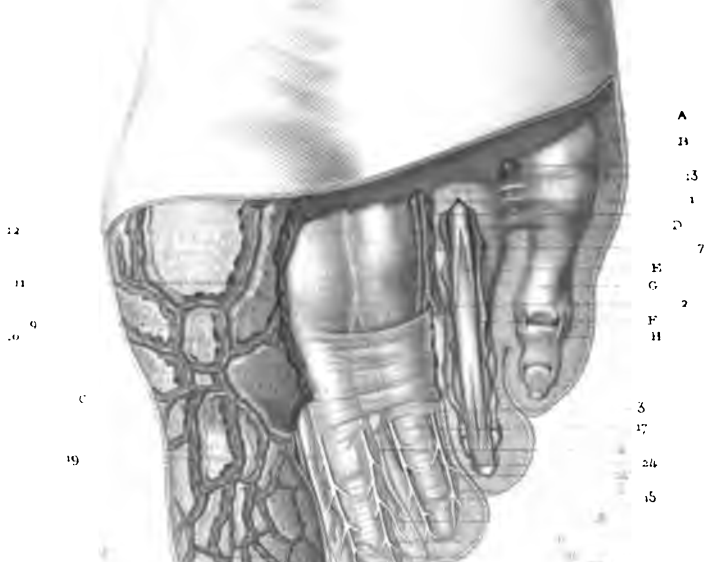

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LIBRAIRIE GERMER BAILLIÈRE

PLATE CIX.

FIGURE 1.—**Region of the Toes.**

Dorsal surface.

EXPLANATION.

A. Section of the skin bounding the region.
B. Section of the subcutaneous fatty cellular tissue.
C. Section of the superficial fascia.
D. Section of the superficial aponeurosis.
E. Tendons of the extensors of the great toe seen through the superficial aponeurosis.
F. Tendons of the extensor of the second toe.
G. First phalanx of the little toe.
H. Tendon of the extensor of the fourth toe seen through its investing fibrous sheath.
I. Lateral fibres of the tendons of the extensor of the fourth toe going to be inserted into the posterior extremity of the third phalanx.
J. Articulation of the first with the second phalanx of the little toe.
K. Second phalanx of the little toe.
L. Termination of the sub-ungueal filament of the external plantar collateral nerve of the second toe.
M. Integument beneath the nail.
N. Nail of the great toe.

1. Internal collateral artery of the great toe.
2. Anastomosis of the internal collateral artery with the external collateral artery of the great toe.
3. External collateral artery of the great toe.
4. Anastomosing arches of the dorsal collateral arteries of the fourth toe.
5. Section of the dorsal collateral artery of the fifth toe.
6. Section of the collateral arteries of the third and fourth toes.
7. External collateral artery of the third toe.
8, 9. Dorsal veins of the great toe.
10. Internal dorsal collateral nerve of the great toe.
11, 12, 13, 14. Dorsal collateral nerves of the toes.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

This Figure shows the dorsal surface of the toes. In passing from the first to the fifth or little toe, we see all the different layers represented. On the great toe we see the subcutaneous layer with its numerous veins. On the second we find the arterial and nervous network placed at a greater depth and in contact with the superficial aponeurosis. On the middle or third toe is represented the subjacent layer, that is, the superficial aponeurosis covering the extensor tendons and forming their sheaths. On the fourth toe this sheath is opened to show the extensor tendons. Lastly, on the fifth is seen the skeleton of the toe, that is to say the three phalanges and their articulations. This examination shows that the anatomical conditions are the same as those of the dorsal surface of the fingers; the diseases will, therefore, be the same. In fact, we meet with similar physical, vital and organic lesions as in the case of the fingers, but we shall also find that there are certain peculiarities which specially belong to the toes.

Physical lesions are here very frequent, for the same reasons as those we have mentioned in regard to the dorsal region of the foot. These lesions consist of injuries produced by pointed or cutting instruments, and especially by crushing. The latter injuries are produced by heavy bodies falling upon the anterior extremity of the foot, or by the wheel of a carriage passing over the part. Sometimes they involve all the toes; sometimes only one, and that may be either entirely or in part; sometimes the contusion is superficial; at other times it occupies two or three layers, and at others the whole of the layers at the same time. When this is the case, the articulations are laid open and the bones are crushed, giving an importance to these wounds, which, at first sight, considering the relative size of the organ, they do not seem to possess. Lastly, if these wounds are occasionally complicated with pyæma—a circumstance which is explained by the number of veins—or by the occurrence of diffuse phlegmon, or of erysipelas, as we have seen in patients under our own charge, it must be remembered that they escape the other most formidable complication of wounds, namely, primary or secondary hæmorrhage. In fact, there are not in any of the layers of this region vessels of sufficient size to give rise to any considerable amount of hæmorrhage.

When the region of the nail is wounded, fragments of the nail may be forced into the tissues, and on feeling them we may be led to suppose that the third phalanx has been crushed, from their resemblance to small splinters of bone. It is sufficient to mention this source of error, in order that it may be avoided. But when the violence has crushed all the tissues, and the matrix of the nail is injured, the wound will be prevented from healing by the fragments of the nail which are scattered about. Under these circumstances it will be necessary to destroy the remains of the matrix with caustic, if we wish the parts to cicatrise.

Inflammation of the dorsal surface presents the same divisions as in the case of the fingers. We have, in fact: 1. superficial or cutaneous paronychia with its several varieties; 2. a subcutaneous paronychia; 3. paronychia of the sheath; 4. a periosteal paronychia; 5. an osseous paronychia.

A somewhat common affection is met with on the dorsal surface of the toes: we refer to *curvature of the nail (onyxis)*, and to *the growth of the nail into the flesh*, two conditions which some surgeons have erroneously confounded together under the same title. The disease occurs most frequently on the great toe, but it is also met with on the other toes. Sometimes it is met with on both the great toes, as we witnessed in a patient under our care. The disease, which is very painful and prevents the person from walking, has been treated in various ways. The most successful is that in which the matrix of the nail is destroyed. To do this it is sufficient to remove with a large strong bistouri all the soft parts on the ungueal phalanx, including the matrix of the nail. This method is speedy, and has always afforded us good results.

Amongst the organic affections we may mention corns, bunions, fistulæ, and exostosis. In sportsmen, from constant pressure, the skin on the dorsal surface of the toes and on the prominent parts continually increases in thickness, especially the epidermal portion; this becomes hardened, and soon forms a small rounded tumour called a *corn*. Sometimes the epidermis is thickened in layers; while the subjacent dermis becomes irritated, gives rise to a collection of serum, and forms a *bunion*. Sometimes the thin skin between the toes participates in the inflammation and it then extends to the interdigital subcutaneous cellular tissue. This produces a separation of the skin, and the opening of the abscess remains for a long time in a fistulous condition. We had occasion to treat a similar disorder in a patient who had tried every means of curing it. It was supposed that there existed a carious or necrosed condition of the bone, and even the presence of white swelling had been mentioned. We had only to remove the portion of the skin which had been separated to obtain a speedy cure. On the dorsal surface of the third phalanx of the great toe we sometimes meet with an exostosis which raises up the nail and gives rise to derangements that have been described by Dupuytren. In this case the nail must be removed, and after having destroyed the soft parts, the exostosis excised with a pair of strong cutting forceps.

FIGURE 2.—Region of the Toes.

Plantar surface.

EXPLANATION.

A. Section of the skin.
B. Section of the subcutaneous fatty cellular tissue.
C. Superficial aponeurosis.
D. Tendons of the flexors of the fourth toe.
E. Tendon of the long flexor passing into the sheath of the short flexor of the toes.
F. Section of the sheath of the tendons of the flexor of fourth toe.
G. Dorsal surface of the first phalanx of the little toe.
H. Second phalanx of the little toe.

1. Interosseous artery furnishing the collateral plantar arteries to the middle and fourth toe.
2. Internal collateral plantar artery of the fourth toe.
3. External collateral plantar artery of the middle toe.
4. Internal collateral plantar artery of the middle toe.
5. Anastomosis of the two collateral plantar arteries of the middle toe.
6. Sub-ungueal artery of the second toe.
7. Vein accompanying the interosseous arteries.
8. Subcutaneous venous network of the plantar surface of the great toe.
9, 10, 11, 12. Venous trunk arising from the subcutaneous venous network.
13. Interosseous plantar veins.
14, 14. Collateral plantar veins.
16. Interosseous plantar veins.
17, 18, 19, 20. Collateral plantar nervous branches.
21. Interosseous nervous branch.
22. Nervous branch going to the dorsal surface of the middle toe.
23. Anastomosis between the terminal branches of the plantar collateral nerves.
24, 25. Transverse anastomoses between the collateral plantar nerves.

APPLICATIONS TO PATHOLOGY AND OPERATIVE SURGERY.

In the anatomical representation of the layers which form the plantar surface of the foot, we have adopted the same method as in the case of the dorsal surface of these organs. That is, the first toe gives a representation of the subcutaneous layer; the second and third toes exhibit the deep layers as far as the aponeurosis; the fourth toe represents the sheath of the flexor tendons laid open; and lastly, the fifth toe exhibits the bones seen from the plantar surface; it is, therefore, unnecessary to speak again of wounds and inflammations as affecting this surface of the toes, since we should only have to repeat what we have previously said with regard to their dorsal surface. We will, however, make one remark, which is, that in the fatty cellular tissue of the great toe there is a rich venous network excavated, as it were, out of its somewhat fibrous-like tissue. From this it arises that these vessels being always kept open resemble in some respects a venous sinus. When, also, we remember that on the dorsal surface of the same toe we find another venous network, this doubtless explains why in an attack of gout the great toe becomes red, congested and painful, so as to prevent any attempt to walk. With regard to operative surgery, we shall presently call attention to the transverse grooves which are situated on the dorsal as well as on the plantar surface of the toes. The surgeon can often guide himself with advantage along these grooves to the joints when he wishes to perform the partial disarticulation of a toe.

When all the toes are to be removed, the surgeon should make use of the skin belonging both to the dorsal and to the plantar surface of the foot. On the dorsal surface, the skin is prolonged beyond the articulation of the first phalanx with the corresponding metacarpal bone for at least two centimetres (·787 English inch); there will, therefore, be a small but useful flap to be taken from this part. On the plantar surface, the fatty and cutaneous cushion is extended still further forwards, extending beyond the articulation of the second with the third phalanx. A flap may be formed from three to four centimetres (1·18 to 1·57 English inch) in length. This length of the two flaps is very favourable to the formation of a cicatrix, which, occupying the dorsal surface, will not be injured in walking. In performing this operation, the toes are held between the thumb and fingers of the left hand. The dorsal incision is carried from side to side of the metatarsal-phalangeal articulations. Care is taken to carry the point of the knife opposite the groove of the toes. In forming the plantar flap, the thumb of the left hand is placed beneath the toes and the fingers on their dorsal surface; held in this way the toes are raised up and the flap dissected off from left to right, following exactly the direction of the groove which exists between the base of the toes and the plantar surface.

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